Welcome to Pediatric Advanced Life Support or PALS by Space Coast Heart Savers

This study guide is an overview of today’s topics.

This is an American Heart Association class specific for providers needing Pediatric Advanced Life Support. As we go through the course always keep in mind that Basic Life Support is the most important key to success and survival. Good BLS=good PALS. Never stray from a good solid foundation of BLS. These little lives depend on it.

The number 1 cause for cardiac arrest in pediatrics is RESPIRATORY (hypoxia). Whether it’s a bacteria or virus, airway obstruction (upper or lower), drowning, lung tissue disease process or congenital disability.

The four different types of airway disabilities that cause distress/failure are:

- **Upper airway**: inspiratory wheezes, stridor, “barky cough,” (aka croup), allergies, foreign body

  Tx.’s- Warm humidified air/oxygen (hot steamy shower or sink in an enclosed bathroom then directly outside directly into air.) Medical treatments is humidified O2, steroids, aerosoled racemic epi.


  Tx.’s-Nebulized albuterol, O2 prn, antibiotics

- **Lung tissue disease**: Pneumonia, grunting, prolonged exhalation with accessory muscle use, excess “work of breathing,” crackles.

  Tx.’s: albuterol, (bronchodilators), O2, antibiotics, if its cardiac related due to congenital issues may need diuretics or other medications.
Disordered control of breathing: Tumors, stroke, brain injuries, seizures, congenital abnormalities, uncontrolled endocrine disorders (DKA from diabetes).

Tx.’s- O2, PPV (if severe), diabetic or seizure meds, possible intubation.

Epiglottitis is considered a very serious upper airway problem. If severe enough, can cause an upper airway obstruction due to swelling and difficulty swallowing and breathing. This is considered a medical emergency and these patients need CT scan to rule out abscesses, broad spectrum antibiotics, most likely admission for respiratory control and observation.

Get a good history and assessment right off the bat. SAMPLE:

S- Signs/symptoms

A- Allergies

M- Medications

P- Pertinent Past Medical History

L- Last Oral Intake

E- Events leading up to the Illness or Injury
Pediatric Weight and Dosing

The most recommended way to calculate drug dosages in an emergent situation is with the Broselow Tape. If one is unavailable, the Handtevy Method is a quick way some pre-hospital personnel use to determine pediatric weight in kg. As you can see by the diagram of the hand each finger represents a year in age. One year starts at the thumb at 10kg and goes up 5 kg per finger every other year (1, 3, 5, 7, 9). Most pediatric medications are measured in mg/kg. This is a quick helpful tool to help in calculations.
BROSELOW TAPE/CHART for quick reference to pediatric weight, dosages, and equipment size. The colors on the tape correlate to a pediatric crash cart.

A 4 year old child would be 16-18 kg. A 2 year old child is 12-14 kg.

The most accurate way to calculate pediatric weights from pounds to kilograms is divide the weight in pounds by 2.2. Ex: a 32 pound child would be 14.5 kg.

One last way to figure out a weight quickly is to take their weight in pounds and divide by two. Then subtract 10%. Ex: a 22 pound baby would be 22/2 = 11 11-10% (is 1.1) so the child is appx. 10 kg. Ex: child is 48 pounds 48/2= 24 24-10% (2.4) = 21.5 kg.

Practice and find out whatever way is the most accurate and efficient way for you.

Epinephren is 0.01 mg/kg it comes in a 10 ml syringe of 1/10:000. If the child weighs 10 kg then it would be calculated as:

0.01mg/kg x 10kg=0.1 mg of epi. A 10ml syringe has 1 mg of epi. You only need 0.1mg so you would draw up 1 ml.

**Shock**

The definition of shock in inadequate tissue perfusion. This can be the delivery of glucose or oxygen to peripheral issues or organs. This can lead to life-threatening emergencies. There can be several reasons for this and different types of shock. What we, as medically trained personnel, need to be concerned with is compensated vs. uncompensated shock. Is it reversible? What can we do to prevent it from getting worse? What is the cause? What interventions do they need now?

Compensated Shock is earlier of the two. Blood pressure is still within the normal range. THIS IS THE BIGGEST PREDICATE FOR COMPENSATED VS. UNCOMPENSATED SHOCK. Their heart rate will be elevated. This is their normal compensatory mechanism from the body to try and re-perfuse and deliver the necessary glucose and oxygen back to the deprived tissues.

Uncompensated Shock is later. Blood pressure is low. End organ damage is usually present. Patient is usually unresponsive and not tolerating life saving measures. Their O2 sats are low, respirations are not adequate (rate or quality), and they could have cool extremities and a warm core from shunting.

Primary Assessment: ABCDE

A-Airway
B-Breathing
C-Circulation
D-Disability
E-Exposure
Types of Shock:

**Hypovolemic:** caused be too little of volume. Blood or fluids. Dehydration. Third spacing. Trauma. Vomiting and diarrhea. It causes intravascular fluid loss. This has decreased cardiac filling that results in decreased preload and afterload. Their cardiac output is poor and perfusion is inadequate. Poor oral intake is a main cause. Hemorrhage is another contributor from trauma (penetrating trauma, external hemorrhage or blunt trauma with internal hemorrhage), burns, DKA (diabetic keto acidosis and polyuria), as well as environmental exposures and peritonitis.

**Distributive:** Massive vasodilation. *SEPTIC* Neurogenic (high level spinal cord injuries). Anaphylaxis. Peripheral vasodilation occurs flushing fluids to the extremities and a decrease in systemic vascular resistance. Pediatrics that may have a high grade fever or are hypothermic may have septic shock. Infants or neonates younger than three months can present with septic shock without a fever.

**Cardiogenic:** Cardiomyopathy, Arrhythmias. This causes decreased cardiac output due to decreased systolic function. Some neonates with hepatomegaly or heart murmur may have a ductal abnormality resulting in cardiogenic shock. You should not be as aggressive with fluid therapy on these patients. They should get 5-10ml/kg over 10-20 min.

**Obstructive:** Tamponade, Pulmonary Embolism. Tension Pneumothorax. This is the least common in pediatrics. It’s caused by an acute obstruction in the cardiac pulmonary blood flow.
The most common is septic, then hypovolemic, distributive and then cardiogenic. In septic shock one of the main ways to improve a child’s odds is with antibiotics within the first hour. Normally pediatrics can compensate to increased oxygen demand by increasing the heart rate and cardiac stroke volume. When a child is in shock there becomes some type of impairment to not allow this to happen. Lactate is accumulated and hypoxic injuries occur.

To quickly assess a patient for alertness you can use the acronym AVPU:

A-Alert
V-Responds to verbal stimuli
P-Responds to Painful stimuli
U-Unresponsive

Look at your patient!! Are they lethargic? Poor oral intake? Decreased urinary output? Poor feeding? Tachypnea? Look at their chest and abdomen for paradoxical breathing. Retractions. Increased work. Poor interaction. They might be tachycardic, altered mental status, weak peripheral pulses (LOW BLOOD PRESSURE), CAPILLARY REFILL TIME OF GREATER THAN 2 SECONDS.

Treatment of Shock

The goal is to re-perfuse the tissues and organs. The number one distinction between compensated and uncompensated shock is BLOOD PRESSURE. Re-perfuse with blood, oxygen and fluids. Their mentation, respiratory effort, blood pressure, heart rate, respiratory rate, and capillary refill should all return to normal parameters. Make sure their urine output 1ml/kg/h, have normal BG levels, and other labs return to normal parameters. Make sure the patient has a secured airway before attempting reperfusion therapy. Listen to lung sounds and assess for hepatomegaly before, during, and after fluid administration. If they develop rales or hepatomegaly then discontinue fluid resuscitation. 20 ml/kg of isotonic solution should be administered as a bolus if the child does not have any heart defects or renal impairment. This can be repeated up to three times over a period of 15 minutes. If the child remains in shock, you should suspect hemorrhaging. If the child is hypoglycemic you can infuse dextrose water according to their weight and Broselow recommendation. Refer to the Broselow for continued recommendation if pressors are indicated to increase blood pressure and get the patient to a pediatric ICU.
**Intraosseous Access**

The most significant reason for administering an IO is in *CARDIAC ARREST*. These patients are technically dead and need immediate intervention (access for fluids and meds and shock if indicated by their rhythm if present). You should familiarize yourself with insertion technique and process.

*Contraindications*: trauma, fracture, burns, infections (cellulitis), genetic bone disease, previous insertion attempt at the site

If you attempt an IO you must watch out for swelling and compartment syndrome. You may aspirate after insertion but it is not a requirement. You can push meds and fluids through this site after properly hooking up tubing, using a pressure bag and taking measures to properly secure the device and prevent infection.

Insertion site options are: Distal tibial site in older children, posterior superior iliac spine, and tibial tuberosity.

The size of the IO depends on the size of the infant and can be found on the Broselow Chart.
PALS Strips & Meaning

A. Normal Sinus Rhythm—regular and consistent p waves, a p wave for every QRS complex, narrow QRS so it’s coming from above the ventricles, normal repolarization and rate.

![Normal Sinus Rhythm](image)

B. Sinus Tachycardia—in pediatrics a faster rate then and adult is normal. Could be from crying, fever, respiratory issues, pain, hypovolemia, colic, frustration, or excitement to name some. Get a history on your patient and a good assessment to try and figure out the cause. This strip has regular (but accelerated) rate and rhythm with regular and consistent P-QRS intervals. A narrow complex.

![Sinus Tachycardia](image)

C. Sinus arrhythmia—an inconsistency is noted on some beats. The rate overall is within normal limits for most ages. There are beats with normal P-QRS intervals.

![Sinus Arrhythmia](image)
D. Supraventricular Tachycardia or SVT-is this patient stable or unstable? What interventions could you use? Maneuvers? Medications? If you have to shock them what type of electricity would you use and at what joules? There are no real discernable P waves but there are narrow and consistent QRS complexes that look regular.

![ECG Image]

E. Monomorphic ventricular tachycardia-first question...does it have a pulse? The treatment for these two rhythms is very different and important to decide on. If they have a pulse and you do not sync the rhythm, you could cause an R on T phenomenon and send them into V-fib. What medications can you use for this with a pulse? Without?

![ECG Image]

F. Supraventricular Tachycardia (SVT)-with the administration of adenosine-what’s the appropriate pediatric dosages for adenosine administration? How do you give it? What kind of access do you need? What else can you try?

![ECG Image]
G. Sinus bradycardia-This rate is TOO SLOW.
   a. What meds can be administered in pediatrics? Note: it is different than in adults.
   b. What dose?
   c. What can cause this?
   d. What are some other treatments? There is a p wave for every QRS complex that’s mostly narrow. It’s coming from the atrium.

H. Junctional rhythm-there are no p waves. These beats are originated in the junction of the heart. It is consistent with the internal intrinsic rate and the heart is compensating. What are treatments or this?

I. 3rd degree heart block- p waves and ventricular contractions are wholly inconsistent and irregular. The p waves “march out.” The ventricular contractions “march out.” They’re both doing their job and holding their own. What interventions and treatments for this rhythm? Who should we consult?
J. Asystole—there are a couple of agonal ventricular contractions. Then nothing. What now?

K. Ventricular Fibrillation—needs DEFIBRILLATION! NOW! What are the pediatric dosage for defib? Remember 2-4-6-8 that’s how we defibrillate… that’s joules per kilogram.

L. Ventricular Tachycardia or Torsades de Point— the sideways twister. Which medication do we give specific for this rhythm, dose and rate?
M. Ventricular fibrillation...SHOCK...into a rhythm that look irritable and inconsistent. Need more of a strip but the point is you are able to recognize the delivery of the shock and the rhythm changed out of v-fib.

N. This could be artifact or interference.
ROSC

If a patient achieves ROSC (Return Of Spontaneous Circulation), there are several different steps to take next.

If they remain comatose: Targeted Temperature Management: cool the patient to 32-34 degrees Celsius for 2 days then follow up with 3 days of normalthermia at (36-37.5 degrees Celsius).

O2 with an advanced airway-use the Broselow tape for proper sizing and make sure it is secured well with waveform capnography. Goal is 35-40 mm Hg on Petco2. Try to maintain O2 between 94-99%.

Maintain their blood pressure with fluids and vasopressors according to protocol, orders or guidelines. Make sure you are constantly assessing lung sounds and for hepatomegaly for fluid overload.

EKG and consult expert care.