The American Heart Association released new resuscitation science and treatment guidelines on October 19, 2010.

The new AHA Handbook of Emergency Cardiac Care (ECC) contains these 2010 Guidelines. The 2010 PALS Provider Manual is not yet available. This interim study guide will provide you with additional study information.

Requirements to successfully complete PALS:

Completed PALS Pre-test is required for admission to the course.

Score 84% on the multiple-choice post-test.

You may be allowed to use your ECC Handbook & notes.

You must be able to:

- Use the PALS rapid cardiopulmonary assessment
- Demonstrate effective infant and child CPR
- Use an AED on a child
- Provide safe defibrillation with a manual defibrillator
- Maintain an open airway
- Confirmation effective ventilation
- Address vascular access
- State rhythm appropriate drugs, route and dose
- Understand the consideration of reversible causes
You will need to know:

- **CPR/AED:** foundation for PALS

- **Arrhythmias** (identify):
  - Sinus Rhythm (SR)
  - Sinus Bradycardia (SB)
  - Sinus Tachycardia (ST)
  - Supraventricular Tachycardia (SVT)
  - Ventricular Tachycardia (VT)
  - Ventricular Fibrillation (VF)
  - Pulseless Electrical Activity (PEA)
  - Asystole

- **Normal Respiratory Rate** (ECC Handbook p. 74)

<table>
<thead>
<tr>
<th>Age</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>30-60</td>
</tr>
<tr>
<td>Toddler</td>
<td>24-40</td>
</tr>
<tr>
<td>Preschooler</td>
<td>22-34</td>
</tr>
<tr>
<td>School-age</td>
<td>18-30</td>
</tr>
</tbody>
</table>

- **Normal Heart Rate** (ECC Handbook p. 74)

<table>
<thead>
<tr>
<th>Age</th>
<th>Sleeping</th>
<th>Awake</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3 months</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>3 months - 2 years</td>
<td>75</td>
<td>-</td>
</tr>
<tr>
<td>2–10 years</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>10 + years</td>
<td>50</td>
<td>-</td>
</tr>
</tbody>
</table>

- **Hypotension by Systolic Blood Pressure (SBP)** (ECC Handbook p. 74)

<table>
<thead>
<tr>
<th>Age</th>
<th>SBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 month</td>
<td>&lt; 60</td>
</tr>
<tr>
<td>1 month – 1 year</td>
<td>&lt; 70</td>
</tr>
<tr>
<td>1 – 10 years</td>
<td>&lt; 70 + (2 x age in years)</td>
</tr>
<tr>
<td>10+ years</td>
<td>&lt; 90</td>
</tr>
</tbody>
</table>

- **Hypotension + signs of poor perfusion = decompensated shock**
  (ECC Handbook p. 74)
**Differential Diagnosis**

“H’s and T’s”, “Seek & Treat Possible Causes”, “Reversible Causes”, “PATCH MD”

**6Hs** (Spacing separations may help as a memory aid)

- Hypoxia
- Hypovolemia
- Hypothermia
- Hypoglycemia
- Hypo/hyperkalemia
- Hydrogen ion (acidosis)

**5 Ts**

- Tamponade
- Tension pneumothorax
- Toxins – poisons, drugs
- Trauma
- Thrombosis – coronary (AMI), – pulmonary (PE)

**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.

**General appearance:**

**Level of consciousness:**

- A  = awake  
- V  = responds to verbal 
- P  = responds to pain 
- U  = unresponsive

**Overall color:**

- good  
- bad

**Muscle tone:**

- good  
- “floppy”
*** Assess ABCs:
(Stop and give immediate support when needed, then continue with assessment)

Airway:
Open and hold with head tilt-chin lift

Breathing:
- Present or absent
- Rate: normal - slow - fast
- Pattern: regular - irregular - gasping
- Depth: normal - shallow - deep
- Sound: stridor - grunting - wheezing
- Exertion: nasal flaring - sternal retractions - accessory muscle use

Circulation:
- Central pulse: present - absent
- Rate: normal - slow - fast
- Rhythm: regular - irregular
- QRS: narrow - wide

*** Perfusion:
- Central pulse versus peripheral pulse strength: equal - unequal
- Skin color, pattern and temperature: normal - abnormal
- Capillary refill: normal - abnormal (greater than 2 seconds)
- Liver edge palpated at the costal margin:
  - normal
  - dry
  - below costal margin (fluid overload)

*** Check:
- Systolic BP (normal or compensated): acceptable for age - hypotensive
- Urine output: normal= 1– 2cc/kg/hr, (infants and children), 30cc/hr (adolescents)
  - adequate
  - inadequate

*** 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 appropriate treatment algorithm:

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

Advanced Airway

A cuffed or uncuffed Endotracheal Tube (ET) may be used on Infants and children.
ECC Handbook p. 87

To estimate tube size:

Uncuffed: \( (\text{Age in years} \div 4) + 4 \)  
Example: \( (4 \text{ years} \div 4) = 1 + 4 = 5 \)

Cuffed: \( (\text{Age in years} \div 4) + 3 \)  
Example: \( (4 \text{ years} \div 4) = 1 + 3 = 4 \)

Immediately confirm tube placement by clinical assessment and a device:

► Clinical assessment:
  - Look for bilateral chest rise.
  - Look for water vapor in the tube (if seen this is helpful but not definitive).
  - Listen for breath sounds over stomach and the 4 lung fields (left and right anterior and mid-axillary).

► Devices:
  - End-Tidal CO2 Detector (ETD): if weight > 2 kg
    Attach between the ETT and BVM:
    - Litmus paper center should change color with each inhalation and each exhalation.
    - Original color on inhalation = \( O_2 \) is being inhaled: expected.
    - Color change on exhalation = Tube is in trachea.
    - Original color on exhalation = 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 turkey baster)
  Compress the bulb and attach to end of ETT:
  - 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:** ET tube is not in trachea or has moved into a bronchus (**right mainstem most common**)
  - **Obstruction:** Consider secretions or kinking of the tube
  - **Pneumothorax:** Consider chest trauma, barotrauma or non-compliant lung disease
  - **Equipment:** Check oxygen source, BVM and ventilator

**PALS Medications**

**During 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

**Antiarrhythmics:**

**Amiodarone:** atrial and ventricular antiarrhythmic

ECC Handbook p. 89 Slows AV nodal and ventricular conduction, increases the QT interval and may cause vasodilation.

  - **VF/PVT:** IV/IO: 5 mg/kg bolus
  - **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
  - **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 q. 5–15 min
Perfusing VT: IV/IO: 1 mg/kg bolus q. 5-15 min
Infusion: 20-50 mcg/kg/min
Caution: neuro toxicity → seizures

Magnesium: ventricular antiarrhythmic for Torsade and hypomagnesemia
ECC Handbook p. 94

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

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

Increase heart rate:

Epinephrine: Drug of choice for pediatric bradycardia after oxygen and ventilation
ECC Handbook p. 92
Dose is the same as listed above.

Atropine: Vagolytic to consider after oxygen, ventilation and epinephrine
ECC Handbook p. 89
Blocks vagal input therefore increases SA node activity and improves AV conduction.

IV/IO: 0.02 mg/kg; may double amount for second dose
Child max: 1 mg
Adolescent max: 2 mg
Caution: Do not give less than 0.1 mg, or may worsen the bradycardia

Decrease heart rate:

Adenosine: Drug of choice for symptomatic SVT
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
- 2nd 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  
Increase 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: max recommended: should not exceed D25%; hyperglycemia may worsen neuro outcome

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

- < 5 yrs or 20 kg: IV/IO: 0.1 mg/kg  
- >5yrs or 20kg: IV/IO: up to 2mg  
- Caution: half-life is usually less than the half-life of narcotic, so repeat dosing is often required;

**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.