Participants of 2010 PALS w/ Updates:

Please, print this workbook and bring it to class.

PALS participants that are current, will only attend the last session of the scheduled classes for the update course. Please bring a copy of your current PALS & CPR cards with you to class. Initial attendees will attend both sessions, for the 2010 ASHI-PALS guidelines, with updates.

If you are new to PALS don’t memorize or be overwhelmed by the enclosed material. Review and relax. Be familiar with the material and we’ll show you how to put it together and the memory will be easier!

You must be current in CPR-Pro/BLS for Healthcare Providers, with AED, during this course and a copy of your card(s) must be presented or sent to us to be retained for our files.

If you need your BLS w/AED, I will have a BLS Instructor at all classes to accommodate your LESS STRESS needs. This class is normally $50.00, but if taken with PALS it is just $35.00 extra. Please let us know if your intentions, prior to class time.

Successful completion of this course requires preparation prior to the course dates. You need to read and study, not memorize, the enclosed materials. We will have more material and books AVAILABLE prior to and at class. Please call or e-mail us at greencoeducation@aol.com to find out more information.

You must have some prior knowledge or learn EKG interpretation and medications used for this class. The algorithms and EKG’s enclosed are what you will be evaluated on.

The pre-test is not the same as the Post-test. If you know the material you will have no problems. ALL testing is done on a TEAM basis. We share knowledge and experiences, not dictate them. We’re not here to show you how much we know, we’re here to help you learn and understand the material presented. Know the materials and you will have no problem doing great!

Visit our web site at “greencoeducation.com” for more information AND DON’T FORGET FOOD AND BEVERAGES ARE SERVED AT ALL OUR CLASSES.

We're looking forward to meeting you, having some fun and if I have left any questions unanswered, feel free to call anytime.

See you at the Class!

Sincerely,

Randall Green, IT
Training Center Coordinator
GreenCo Education.com
The following GreenCo Education Worksheets are formatted and displayed to be more easily understood for the reader.

Books will be available at class time for reference.

Remember:

“There’s NEVER an ALWAYS” with patients or guidelines.

CPR is no exception.

Only practice and an actual event give us the practical knowledge to become proficient in our trade.

At the conclusion of your class you will be qualified to run a basic code! However, you need experience to handle the code and the task of doing CPR. You have the basics to get involved and start learning what it takes, and; why you are doing a procedure.

Surprise!! Your real learning starts at the END of class!

What’s HOT, What’s NOT
ASHI CPR Pro

This document outlines the recent changes in CPR training guidelines that your instructor is incorporating into your training class. For each change, the previous guideline from 2005, the updated guideline from 2010, and the rationale for the change is provided.

<table>
<thead>
<tr>
<th>Topic</th>
<th>2005</th>
<th>2010</th>
<th>Reason for Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emphasis on High-Quality CPR</td>
<td>“The available evidence suggests that blood flow is optimized by using the recommended chest compression force and duration and maintaining a chest compression rate of approximately 100 compressions per minute. These guidelines recommend that all rescuers minimize interruption of chest compressions for checking the pulse, analyzing rhythm, or performing other activities (Class IIa). CPR instruction should emphasize the importance of allowing complete chest recoil between compressions.” (Circulation. 2005; 112: IV19-IV34]</td>
<td>“To provide effective chest compressions, push hard and push fast. It is reasonable for laypersons and healthcare providers to compress the adult chest at a rate of at least 100 compressions per minute (Class IIa, LOE B) with a compression depth of at least 2 inches/5 cm (Class IIa, LOE B). Rescuers should allow complete recoil of the chest after each compression, to allow the heart to fill completely before the next compression (Class IIa, LOE B). Rescuers should attempt to minimize the frequency and duration of interruptions in compressions to maximize the number of compressions delivered per minute (Class IIa, LOE B)” (Berg, et al. Circulation. 2010;122;S685-S705)</td>
<td>The importance of high-quality chest compressions within CPR remains a critical focal point. Well-performed compressions increase the likelihood of overall survival. Recommendations center on improving the parts of the compression skill found to have the most influence on quality.</td>
</tr>
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</tr>
<tr>
<td>Compression Rate</td>
<td>“There is insufficient evidence from human studies to identify a single optimal chest compression rate. Animal and human studies support a chest compression rate of &gt;80 compressions per minute to achieve optimal forward blood flow during CPR. We recommend a compression rate of about 100 compressions per minute (Class IIa).” (Circulation. 2005; 112; IV19-IV34)</td>
<td>“It is reasonable for laypersons and healthcare providers to compress the adult chest at a rate of at least 100 compressions per minute (Class IIa, LOE B) with a compression depth of at least 2 inches/5 cm (Class IIa, LOE B).” (Berg, et al. Circulation. 2010; 122; 5685-S705)</td>
<td>It has been found that higher survival rates are associated with an increase in the number of compressions provided per minute and lower survival rates are associated with a decrease in that number. Recommending a base-level compression rate instead of a fixed rate allows for the benefit of an increased compression rate. There is not enough evidence to provide a recommended specific upper limit for compression rate.</td>
</tr>
<tr>
<td>Compression Depth</td>
<td>“Depress the sternum approximately 1 ½ to 2 inches (approximately 4 to 5 cm) and then allow the chest to return to its normal position.” (Circulation. 2005; 112; IV19-IV34)</td>
<td>“It is reasonable for laypersons and healthcare providers to compress the adult chest at a rate of at least 100 compressions per minute (Class IIa, LOE B) with a compression depth of at least 2 inches/5 cm (Class IIa, LOE B).” (Berg, et al. Circulation. 2010; 122; 5685-S705)</td>
<td>Research indicates the tendency for CPR providers to not compress deep enough, even with the emphasis to “push hard.” There is not enough evidence to provide a recommended specific upper limit for chest compression depth. The research also indicates the 2-inch depth for adult compression is more effective than a depth of 1 ½ inches.</td>
</tr>
<tr>
<td>Compression Hand Position</td>
<td>“The rescuer should compress the lower half of the victim’s sternum in the center (middle) of the chest, between the nipples. The rescuer should place the heel of the hand on the sternum in the center (middle) of the chest between the nipples and then place the heel of the second hand on top of the first so that the hands are overlapped and parallel (LOE 6; Class IIa).” (Circulation. 2005; 112; IV19-IV34)</td>
<td>“The rescuer should place the heel of one hand on the center (middle) of the victim’s chest (which is the lower half of the sternum) and the heel of the other hand on top of the first so that the hands are overlapped and parallel (Class IIa, LOE B).” (Berg, et al. Circulation. 2010; 122; 5685-S705)</td>
<td>Use of the nipple line as a landmark for hand placement was found to be unreliable.</td>
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</tr>
<tr>
<td>Breathing</td>
<td>“While maintaining an open airway, look, listen, and feel for breathing.”</td>
<td>“After activation of the emergency response system, all rescuers should immediately begin CPR for adult victims who are unresponsive with no breathing or no normal breathing (only gasping).”</td>
<td>There is a high likelihood of agonal or irregular gasping breaths to occur early in cardiac arrest. These reflex actions make the recognition of cardiac arrest confusing for rescuers who have never seen agonal breaths before. Simplifying the breathing assessment to looking for no breathing or no normal breathing helps rescuers respond more quickly with chest compressions and CPR.</td>
</tr>
<tr>
<td>CPR Sequence</td>
<td>For an unresponsive person who is not breathing or not breathing normally, begin CPR by opening the airway and giving 2 rescue breaths followed with 30 chest compressions. Repeat cycles of 30:2 (ABC method).</td>
<td>For an unresponsive person who is not breathing or not breathing normally, and has no obvious pulse, begin CPR with 30 compressions followed by opening the airway and giving 2 rescue breaths. Repeat cycles of 30:2 (CAB method).</td>
<td>The science indicates the importance of not delaying chest compressions to perform rescue breaths. Early chest compression can immediately circulate oxygen that is still in the bloodstream. By changing the sequence, chest compressions are initiated sooner and the delay in ventilation should be minimal.</td>
</tr>
<tr>
<td></td>
<td>(Summary from Circulation. 2005; 112: IV19-IV34)</td>
<td>(Summary from Berg. et al. Circulation. 2010;122;9685-5705)</td>
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</tr>
<tr>
<td>Child and Infant Compression Rate</td>
<td>“Push fast; push at a rate of approximately 100 compressions per minute.”</td>
<td>“Push fast; push at a rate of at least 100 compressions per minute.”</td>
<td>It has been found that higher survival rates are associated with an increase in the number of compressions provided per minute.</td>
</tr>
<tr>
<td>Child Compression Depth</td>
<td>“Push hard”: push with sufficient force to depress the chest approximately one third to one half the anterior-posterior diameter of the chest.”</td>
<td>“The following are characteristics of high-quality CPR: Chest compressions of appropriate rate and depth. Push fast”: push at a rate of at least 100 compressions per minute. ‘Push hard’: push with sufficient force to depress at least one third the anterior-posterior (AP) diameter of the chest or approximately 1 ½ inches (4 cm) in infants and 2 inches (5 cm) in children (Class I, LOE C).”</td>
<td>Research indicates there is a common tendency for CPR providers to not compress deep enough, even with the emphasis to &quot;push hard.&quot;</td>
</tr>
<tr>
<td>Infant Compression Depth</td>
<td>“Push hard”: push with sufficient force to depress the chest approximately one third to one half the anterior-posterior diameter of the chest.”</td>
<td>“The following are characteristics of high-quality CPR: Chest compressions of appropriate rate and depth. Push fast”: push at a rate of at least 100 compressions per minute. ‘Push hard’: push with sufficient force to depress at least one third the anterior-posterior (AP) diameter of the chest or approximately 1 ½ inches (4 cm) in infants and 2 inches (5 cm) in children (Class I, LOE C).”</td>
<td>Research indicates there is a common tendency for CPR providers to not compress deep enough, even with the emphasis to &quot;push hard.&quot;</td>
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<tr>
<td>Child and Infant</td>
<td>“While maintaining an open airway, take no more than 10 seconds to</td>
<td>“If the victim is unresponsive and not breathing (or only gasping),</td>
<td>There is a high likelihood of agonal, or irregular gasping, breaths occurring</td>
</tr>
<tr>
<td>Breathing Assessment</td>
<td>check whether the victim is breathing: Look for rhythmic chest</td>
<td>begin CPR. Sometimes victims who require CPR will gasp, which may be</td>
<td>early in cardiac arrest. These reflex actions make the recognition of cardiac</td>
</tr>
<tr>
<td></td>
<td>and abdominal movement, listen for exhaled breath sounds at the nose</td>
<td>misinterpreted as breathing. Treat the victim with gasps as though there</td>
<td>arrest confusing for rescuers who have never seen them before. Simplifying the</td>
</tr>
<tr>
<td></td>
<td>and mouth, and feel for exhaled air on your cheek. Periodic gasping,</td>
<td>is no breathing and begin CPR.”</td>
<td>breathing assessment to looking for no breathing or only gasping is intended to</td>
</tr>
<tr>
<td></td>
<td>also called agonal gasps, is not breathing.”</td>
<td></td>
<td>help rescuers respond more quickly with chest compressions and CPR.</td>
</tr>
<tr>
<td></td>
<td>(Circulation. 2005; 112: IV156-IV166)</td>
<td>(Berg, et al. Circulation. 2010;122;S862-S875)</td>
<td></td>
</tr>
<tr>
<td>Child and Infant</td>
<td>For an unresponsive child who is not breathing or not breathing</td>
<td>For an unresponsive child who is not breathing or not breathing</td>
<td>The recommended sequence for children and infants is the same as the adult to</td>
</tr>
<tr>
<td>CPR Sequence</td>
<td>normally, begin CPR by opening the airway and giving 2</td>
<td>normally, begin CPR with 30 compressions followed by</td>
<td>help simplify learning. Ventilations are very important in child or infant CPR.</td>
</tr>
<tr>
<td></td>
<td>rescue breaths followed with 30 chest compressions. Repeat cycles</td>
<td>opening the airway and giving 2 rescue breaths. Repeat cycles of 30:2</td>
<td>It is not known whether starting with compressions or breaths makes a difference</td>
</tr>
<tr>
<td></td>
<td>of 30:2 (ABC method).</td>
<td>(CAB method).</td>
<td>in the outcome. Starting CPR with compressions should only delay rescue breaths</td>
</tr>
<tr>
<td></td>
<td>(Summary from Circulation. 2005; 112: IV156-IV166)</td>
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<td>about 18 seconds.</td>
</tr>
</tbody>
</table>

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PALS  
GCE Study Supplement  
GCE Study Supplement
The Chain of Survival

The actions linking the victim of sudden cardiac arrest with survival are called the Chain of Survival. The first link of this chain indicates the importance of recognizing those at risk of cardiac arrest and calling for help in the hope that early treatment can prevent arrest. The central links depict the integration of CPR and defibrillation as the fundamental components of early resuscitation in an attempt to restore life. Immediate CPR can double or triple survival from VF OHCA. Performing chest-compression-only CPR is better than giving no CPR at all. Following VF OHCA, cardiopulmonary resuscitation plus defibrillation within 3–5 min of collapse can produce survival rates as high as 49–75%. Each minute of delay before defibrillation reduces the probability of survival to discharge by 10–12%. The final link in the Chain of Survival, effective post-resuscitation care, is targeted at preserving function, particularly of the brain and heart. In hospital, the importance of early recognition of the critically ill patient and activation of a medical emergency or rapid response team, with treatment aimed at preventing cardiac arrest, is now well accepted. Over the last few years, the importance of the post-cardiac arrest phase of treatment, depicted in the fourth ring of the Chain of Survival, has been increasingly recognized. Differences in post-cardiac arrest treatment may account for some of the inter-hospital variability in outcome after cardiac arrest.

Adult Foreign Body Airway Obstruction Treatment

1. Assess severity
2. Severe airway obstruction (ineffective cough)
   - Unconscious: Start CPR
   - Conscious: 5 back blows, 5 abdominal thrusts
3. Mild airway obstruction (effective cough)
   - Encourage cough
   - Continue to check for deterioration to ineffective cough or until obstruction relieved
What’s HOT, What’s NOT

BLS/ CPR 2010 Guidelines

ALL RESCUERS
The 5 major changes in the 2010 guidelines are these:

• CAB - Emphasis on, and recommendations to improve, delivery of effective chest compressions

• A single compression-to-ventilation ratio for all single rescuers for all victims (except newborns)

• Recommendation that each rescue breath be given over 1 second and should produce visible chest rise

• Recommendation that single shocks, be followed by immediate CPR, be used to attempt defibrillation for VF cardiac arrest. Rhythm checks should be performed every 2 minutes.

• Endorsement of the ILCOR recommendation for use of AEDs in children 1 to 8 years old (and older); use a child dose-reduction system if available, if not use adult pads..

BLS for HCP include the following: ABC’s then> CAB

• Healthcare provider “child” CPR guidelines now apply to victims 1 year to the onset of puberty.

• Lone healthcare providers should tailor their sequence of actions for the most likely cause of arrest in victims of all ages.

  " Phone first" and get the AED and return to start CPR and use the AED for all adults and any children with out-of hospital sudden collapse.

  “ CPR first” (provide about 5 cycles or 2 minutes of CPR before activating the emergency response number) for unresponsive infants and children (except infants and children with sudden, witnessed collapse) and for all victims of likely hypoxic (asphyxial) arrest (e.g, drowning, injury, drug overdose).

• Opening the airway remains a priority for an unresponsive trauma victim with suspected cervical spine injury; if a jaw thrust without head extension does not open the airway, healthcare providers should use the head tilt–chin lift maneuver.

• Basic healthcare providers check for “adequate” breathing in adults and presence or absence of breathing in infants and children before giving rescue breaths. Advanced providers will look for “adequate” breathing in victims of all ages and be prepared to support oxygenation and ventilation.

• Healthcare providers may need to try “a couple of times” to reopen the airway and deliver effective breaths (ie, breaths that produce visible chest rise) for infant and child victims.

• Excessive ventilation (too many breaths per minute or breaths that are too large or too forceful) may be harmful and should not be performed.

• Chest compressions are recommended if the infant or child heart rate is less than 60 per minute with signs of poor perfusion despite adequate oxygenation and ventilation. This recommendation was part of the 2000 guidelines but was not emphasized in courses. It will now be emphasized in the courses.

• Rescuers must provide compressions of adequate rate and depth and allow adequate chest recoil with minimal interruptions in chest compressions.

• Use 1 or 2 hands to give chest compressions for a child; press on the sternum at the nipple line. For the infant, press on the sternum just below the nipple line.

• During 2-rescuer infant CPR, the 2 thumb–encircling hands technique should include a thoracic squeeze.
Healthcare providers should use a 30:2 compression-to-ventilation ratio for 1-rescuer CPR for victims of all ages and for 2-rescuer CPR for adults. Healthcare providers should use a 15:2 compression-to-ventilation ratio for 2-rescuer CPR for infants and children.

During 2-rescuer CPR with an advanced airway in place, rescuers no longer provide cycles of compressions with pauses for ventilation. The compressor provides continuous compressions and the rescuer providing rescue breaths gives 8 to 10 breaths per minute (1 breath about every 6 to 8 seconds).

When 2 or more healthcare providers are present during CPR, rescuers should rotate the compressor role every 2 minutes.

Actions for FBAO relief were simplified. Alert PT - Abominal Thrusts same as Heimlich!

What did NOT change:
- Checking for response
- Pulse check
- Rescue breathing without chest compressions
- Location of hands or fingers for adult chest compressions
- Compression rate
- Compression depth for adults, infants, or children (note that for infants and children the depth of compression is listed as one third to one half the depth of the chest and is no longer listed in inches)
- Ages for use of infant BLS recommendations

For Healthcare Providers priority defibrillation:
- Immediate defibrillation is appropriate for all rescuers responding to sudden collapse with an AED on site (for victims ≥ 1 year of age). Compression before defibrillation may be considered when EMS arrival at the scene of sudden collapse is > 4 to 5 minutes after the call.
- One shock followed by immediate CPR, beginning with chest compressions, is used for attempted defibrillation. The rhythm is checked after 5 cycles of CPR or 2 minutes.
- For attempted defibrillation of an adult, the dose using a monophasic manual defibrillator is 360 J.
- The ideal defibrillation dose using a biphasic defibrillator is the dose at which the device waveform has been shown to be effective in terminating VF. The initial selected dose for attempted defibrillation using a biphasic manual defibrillator is 150 J to 200 J for a biphasic truncated exponential waveform or 120 J for a rectilinear biphasic waveform. The second dose should be the same or higher. If the rescuer does not know the type of biphasic waveform in use, a default dose of 200 J is acceptable.
- Elements of successful community lay rescuer AED programs were revised.
- Instructions for shocking VT were clarified.

What did NOT change:
- The initial dose for attempted defibrillation for infants and children using a monophasic or biphasic manual defibrillator. First dose 2 J/kg; second and subsequent doses 2-4 J/kg, 10 J/kg max.
- The dose for synchronized cardioversion for infants and children
- The dose for synchronized cardioversion for supraventricular arrhythmias and for stable, monomorphic VT in adults
A quick and simple guide to operating an AED

Automated external defibrillators are available in several models, all of which operate basically the same way. The devices incorporate a rhythm analysis system and a shock advisory system. If possible, place the AED close to the supine patient's left ear to provide optimum access to the controls and facilitate placement of the electrodes.

**Generic Directions: Follow the voice prompts even if guidelines are outdated.**

**Step 1: Turn on the AED.** Do this by either lifting the monitor cover or screen to the upright position or pressing the power switch. This initiates voice prompts for subsequent steps.

**Step 2: Attach the electrodes.** Open and attach the two self-adhesive monitor-defibrillator electrode pads directly to the patient's skin. Place the pads on the right upper sternal border below the clavicles and lateral to the left nipple.

**Step 3: Analyze the rhythm.** Clear all nearby persons away from the patient. Some devices require that the operator press an "analyze" button to begin rhythm analysis, while others start analysis automatically when the electrode pads are attached to the chest. If the patient has ventricular fibrillation, the device will announce audibly or by a displayed message that a shock is indicated.

**Step 4: Deliver a shock.** Make sure all nearby persons are clear of the patient and no one is touching him. Press the shock button. Most AED's automatically begin rhythm analysis after each shock and deliver a shock if needed. Some models require the operator to press the "analyze" button once a shock has been delivered. Do not interrupt the shock sequence to check circulation or perform CPR. If the patient does not show signs of circulation after a shock, perform CPR for 2 minutes.
Automated External Defibrillation Algorithm

Unresponsive?
  call for help
  call 911

Open airway
Not breathing normally
  Send or go for AED

CPR 30:2
Until AED is attached

AED assesses rhythm

Shock advised

1 Shock
  Immediately resume:
  CPR 30:2
  for 2 min

Continue until the victim starts
to wake up: to move, open
eyes and to breathe normally

No shock advised

Immediately resume:
CPR 30:2
for 2 min
Healthcare Provider

Is scene safe?
  Yes

Is patient unresponsive?
  No breathing or, No normal breathing? (i.e. gasping)
  Yes
  Send another rescuer to activate emergency response system and get an AED/defibrillator

  No
  Yes
  Give 1 rescue breath every 5-6 seconds (adult). Check for obvious carotid pulse every 2 minutes

  Yes
  Obvious carotid pulse? (no longer than 10 seconds)
  Yes
  30 Compressions
  - Push hard
  - Push fast
  - Allow full chest recoil
  - Minimize interruptions
  - Avoid excessive breaths

  No
  Send another rescuer to activate emergency response system and get an AED/defibrillator

  Send another rescuer to activate emergency response system and get an AED/defibrillator

2 Rescue Breaths

Perform Continuous Cycles (30:2)

Open Airway

When AED/defibrillator arrives, evaluate heart rhythm immediately

- Shockable rhythm
  - Deliver shock and quickly resume CPR

- Non-shockable rhythm
  - Quickly resume CPR

Reevaluate heart rhythm every two minutes until:
- Patient clearly moves
- Another BLS provider takes over
- Advanced life support (ALS) providers assume control
### CPR Summary — Healthcare Provider

<table>
<thead>
<tr>
<th></th>
<th>Adult</th>
<th>Child</th>
<th>Infant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age Determination</strong></td>
<td>Begins with onset of puberty.</td>
<td>About 1 year of age to the onset of puberty.</td>
<td>Less than 1 year of age.</td>
</tr>
<tr>
<td><strong>Scene Safety?</strong></td>
<td>If the scene is unsafe or at anytime becomes unsafe, GET OUT!</td>
<td>If the scene is unsafe or at anytime becomes unsafe, GET OUT!</td>
<td>If the scene is unsafe or at anytime becomes unsafe, GET OUT!</td>
</tr>
<tr>
<td><strong>Response?</strong></td>
<td>Tap shoulder, shout name.</td>
<td>Tap shoulder, shout name.</td>
<td>Tap foot, shout out.</td>
</tr>
<tr>
<td><strong>Breathing?</strong></td>
<td>Look for no breathing or no normal breathing (such as gasping).</td>
<td>Look for no breathing or only gasping.</td>
<td>Look for no breathing or only gasping.</td>
</tr>
<tr>
<td><strong>Normal Breathing Present?</strong></td>
<td>Place person in recovery position and monitor breathing.</td>
<td>Place child in recovery position and monitor breathing.</td>
<td>Place infant in recovery position and monitor breathing.</td>
</tr>
<tr>
<td><strong>Activate Emergency Response System/Get an AED</strong></td>
<td>Send a bystander. When alone, do it yourself immediately.</td>
<td>Send a bystander. When alone, perform about 2 minutes of CPR before doing it yourself.</td>
<td>Send a bystander. When alone, perform about 2 minutes of CPR before doing it yourself.</td>
</tr>
<tr>
<td><strong>Normal Breathing Absent?</strong></td>
<td>Palpate for carotid pulse in neck for no more than 10 seconds.</td>
<td>Palpate for carotid pulse in neck for no more than 10 seconds.</td>
<td>Palpate for brachial pulse in upper arm for no more than 10 seconds.</td>
</tr>
<tr>
<td><strong>Pulse Present?</strong></td>
<td>• Perform rescue breathing: 1 breath every 5-6 seconds. Monitor carotid pulse every 2 minutes.</td>
<td>• If pulse rate is 60 beats per minute or greater, perform rescue breathing: 1 breath every 3-5 seconds. Monitor carotid pulse every 2 minutes.</td>
<td>• If pulse rate is 60 beats per minute or greater, perform rescue breathing: 1 breath every 3-5 seconds. Monitor brachial pulse every 2 minutes.</td>
</tr>
<tr>
<td><strong>Rescue Breaths</strong></td>
<td>• Tilt head, lift chin to open airway first; use jaw thrust for suspected neck injury. 1 second in length. Make chest visibly rise, but no more.</td>
<td>• Tilt head, lift chin to open airway first; use jaw thrust for suspected neck injury. 1 second in length. Make chest visibly rise, but no more.</td>
<td>• Tilt head, lift chin to open airway first; use jaw thrust for suspected neck injury. 1 second in length. Make chest visibly rise, but no more.</td>
</tr>
<tr>
<td><strong>Pulse Absent?</strong></td>
<td>• Perform CPR starting with compressions. Single or multiple rescuers — provide continuous cycles of 30 compressions and 2 rescue breaths.</td>
<td>• If pulse is absent, or less than 60 beats per minute, perform CPR starting with compressions. Single rescuer — provide continuous cycles of 30:2. Multiple rescuers — provide continuous cycles of 15:2.</td>
<td>• If pulse is absent, or less than 60 beats per minute, perform CPR starting with compressions. Single rescuer — provide continuous cycles of 30:2. Multiple rescuers — provide continuous cycles of 15:2.</td>
</tr>
<tr>
<td><strong>Compressions</strong></td>
<td>• Two hands on center of chest, lower half of breastbone At least 2 inches in depth Rate of at least 100 times a minute Hard, fast, complete recoil, minimize interruption</td>
<td>• One or two hands on lower half of breastbone At least ¾ diameter of chest or about 2 inches in depth Rate of at least 100 times a minute Hard, fast, complete recoil, minimize interruption</td>
<td>• Two fingers on breastbone just below nipple line At least ¾ diameter of chest or about 1½ inches in depth Rate of at least 100 times a minute Hard, fast, complete recoil, minimize interruption</td>
</tr>
<tr>
<td><strong>Defibrillation with AED</strong></td>
<td>• Turn on power • Attach pads • Analyze • If indicated, deliver shock • Immediately resume CPR • Follow voice instructions</td>
<td>• Use pediatric system, if not use AED for adult • Turn on power • Attach pads • Analyze • If indicated, deliver shock • Immediately resume CPR • Follow voice instructions</td>
<td>No current recommendation.*</td>
</tr>
</tbody>
</table>

*Note: Updated training guidelines now include the use of AEDs for infants. This will be reflected in updated programs but is not included in the interim materials.

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Use of AED's in infant's is now recommended!
New BLS 2010 Guidelines
Cycles remain the same After the NEW  C-A-B

**Ventricular Fibrillation/Pulseless VT**

1. Cardiac Arrest
2. Defibrillator Arrives
3. Rhythm Check
4. CPR
5. Defibrillator
6. Give Vasopressor
7. Consider Antiarrhythmic
8. Go to CPR

- CPR = 5 cycles or 2 minutes of CPR
- = CPR while defibrillator charging
- = Shock

**Asystole and Pulseless Electrical Activity**

1. Cardiac Arrest
2. Defibrillator Arrives
3. Give Vasopressor, Identify Contributing Factors, For Adult Arrest Consider Atropine
4. CPR
5. Rhythm Check
6. CPR
7. Rhythm Check
8. CPR
9. Rhythm Check
10. Go to CPR

- CPR = 5 cycles or 2 minutes of CPR
The following are the major PALS changes in the 2010 guidelines:

<table>
<thead>
<tr>
<th>Topic</th>
<th>2005</th>
<th>2010</th>
<th>Reason for Change</th>
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<tbody>
<tr>
<td>Simultaneous Actions</td>
<td>Not addressed.</td>
<td>“BLS (whether for a child or adult) is presented as a series of sequential events with the assumption that there is only one responder, but PALS usually takes place in an environment where many rescuers are rapidly mobilized and actions are performed simultaneously. The challenge is to organize the rescuers into an efficient team.” (Kleinman et al., <em>Circulation</em> 2010;122;S876-S908)</td>
<td>Improving the efficiency of care through the organization of care among multiple providers versus a lone provider.</td>
</tr>
<tr>
<td>Chest Compression Depth</td>
<td>“…an adequate compression depth (about one third to one half of the anterior-posterior diameter).”</td>
<td>“…an adequate compression depth (at least one third of the anterior-posterior diameter of the chest or approximately 1 1/2 inches [4 cm] in infants and approximately 2 inches [5 cm] in children).” (Kleinman et al., <em>Circulation</em> 2010;122;S876-S908)</td>
<td>To be effective, chest compressions must be deep.</td>
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<td>“…a good-quality pediatric study showed that during resuscitation of patients &lt;8 years of age, compressions are often too shallow, especially following rescuer changeover... Evidence shows that rib fractures are rarely associated with chest compressions.” (Kleinman et al., <em>Circulation</em> 2010;122;S466-S515)</td>
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<tr>
<td>Cricoid Pressure</td>
<td>&quot;Apply cricoid pressure. You should do so only in an unresponsive victim. This technique may require an additional (third) rescuer if the cricoid pressure cannot be applied by the rescuer who is securing the bag to the face.&quot;</td>
<td>&quot;Apply cricoid pressure in an unresponsive victim (may require a third rescuer if cricoid pressure cannot be applied by the rescuer who is securing the bag to the face) to minimize gastric inflation... There is insufficient evidence to recommend routine cricoid pressure application to prevent aspiration during endotracheal intubation in children.&quot;</td>
<td>There is no evidence that cricoid pressure prevents aspiration during rapid sequence or emergency tracheal intubation in infants or children.</td>
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<td>(Circulation. 2005;112;IV-167-IV-187)</td>
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<td>&quot;If cricoid pressure is used during emergency intubations in infants and children it should be discontinued if it impedes ventilation or interferes with the speed or ease of intubation.&quot;</td>
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<tr>
<td>Tracheal Tube Size</td>
<td>&quot;The formula for estimation of a cuffed endotracheal tube size is as follows: Cuffed endotracheal tube size (mm ID) = (age in years/4) +3.&quot;</td>
<td>&quot;After age 2 it is reasonable to estimate tube size with the following formula: Cuffed endotracheal tube ID (mm) = 3.5 + (age/4).&quot;</td>
<td>Change in formula as aggressive rounding up of age using previous formula commonly resulted in selection of a tube with an internal dimension (ID) 0.5 mm larger than the size derived from the formula.</td>
</tr>
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<tr>
<td>Paddle Position</td>
<td>&quot;Apply firm pressure on the paddles (manual) placed over the right side of the upper chest and the apex of the heart (to the left of the nipple over the left lower ribs). Alternatively place one electrode on the front of the chest just to the left of the sternum and the other over the upper back below the scapula.&quot;</td>
<td>&quot;Follow package directions for placement of self-adhesive AED or monitor/defibrillator pads. Place manual paddles over the right side of the upper chest and the apex of the heart (to the left of the nipple over the left lower ribs) so the heart is between the two paddles. Apply firm pressure. There is no advantage in an anterior-posterior position of the paddles.&quot;</td>
<td>Guidelines recommend the anterior-lateral pad position as the default position “for ease of placement and education.”</td>
</tr>
<tr>
<td>Energy Dose</td>
<td>&quot;With a manual defibrillator (monophasic or biphasic), use a dose of 2 J/kg for the first defibrillation attempt and 4 J/kg for subsequent attempts.&quot;</td>
<td>&quot;It is acceptable to use an initial dose of 2 to 4 J/kg but for ease of teaching an initial dose of 2 J/kg may be considered. For refractory VF, it is reasonable to increase the dose to 4 J/kg. Subsequent energy levels should be at least 4 J/kg, and higher energy levels may be considered, not to exceed 10 J/kg or the adult maximum dose.&quot;</td>
<td>Minor change allowing for higher doses that are believed to be safe and effective.</td>
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(Kleinman et al., Circulation 2010;122;S876-S908)

(Kleinman et al., Circulation 2010;122;S466-S515)

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<td>Infant AED Use</td>
<td>“There is insufficient data to make a recommendation for or against using an AED in infants younger than 1 year of age.”</td>
<td>“In infants younger than 1 year of age a manual defibrillator is preferred. If a manual defibrillator is not available, an AED with a dose attenuator may be used. An AED without a dose attenuator may be used if neither a manual defibrillator nor one with a dose attenuator is available.”</td>
<td>AEDs designed for adults have been used successfully on infants in cardiac arrest.</td>
</tr>
<tr>
<td>Oxygen</td>
<td>“Use 100% oxygen during resuscitation [Class Indeterminate]. Monitor the patient’s oxygen level. When the patient is stable, ween the supplementary oxygen if the oxygen saturation is maintained.”</td>
<td>“It is reasonable to ventilate with 100% oxygen during CPR because there is insufficient information on the optimal inspired oxygen concentration [Class Ila, LOE C]. Once the circulation is restored, monitor systemic oxygen saturation. It may be reasonable, when the appropriate equipment is available, to titrate oxygen administration to maintain the oxyhemoglobin saturation ≥94%.”</td>
<td>There is not enough evidence to recommend a specific weaning protocol. Oxyhemoglobin saturation should be maintained at 94% to 99% when possible.</td>
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(Circulation, 2005;112;IV-167-IV-187)  
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<td>QRS duration</td>
<td>“Wide-Complex Tachycardia (&gt;0.08 Second).”</td>
<td>“Wide-Complex Tachycardia (&gt;0.09 Second).”</td>
<td>Very minor change made to avoid conflict with previously published statement.</td>
</tr>
</tbody>
</table>
• There is further caution about the use of endotracheal tubes. LMA’s are acceptable when used by experienced providers (Class IIb).
• Cuffed endotracheal tubes may be used in infants (except newborns) and children in in-hospital settings provided that cuff inflation pressure is kept <20 cm H2O.
• Confirmation of tube placement requires clinical assessment and assessment of exhaled carbon dioxide (CO2); esophageal detector devices may be considered for use in children weighing >20 kg who have a perfusing rhythm (Class IIb). Correct placement must be verified when the tube is inserted, during transport, and whenever the patient is moved.
• During CPR with an advanced airway in place, rescuers will no longer perform “cycles” of CPR. Instead the rescuer performing chest compressions will perform them continuously at a rate of 100/minute without pauses for ventilation. The rescuer providing ventilation will deliver 8 to 10 breaths per minute (1 breath approximately every 6 to 8 seconds). For further information, see the Basic Life Support for Healthcare Providers section.
• More evidence has accumulated to reinforce that vascular access (IV/IO) is preferred to endotracheal drug administration.
• Timing of 1 shock, CPR, and drug administration during pulseless arrest has changed and now is identical to that for ACLS. See ACLS section for details.
• Routine use of high-dose epinephrine is not recommended (Class III).
• Lidocaine is de-emphasized, but it can be used for treatment of VF/pulseless VT if amiodarone is not available.
• Induced hypothermia (32ºC to 34ºC for 12 to 24 hours) may be considered if the child remains comatose after resuscitation (Class IIb).
• Indications for the use of inodilators are mentioned in the postresuscitation section.
• Termination of resuscitative efforts is discussed. It is noted that intact survival has been reported following prolonged resuscitation and absence of spontaneous circulation despite 2 doses of epinephrine.

Things that have NOT changed in PALS:
• Shock doses for VF/VT (2 to 4 J/kg)
• Shock doses for cardioversion
• Major steps in bradycardia and unstable tachycardia algorithm
• Most drug doses
• Appreciation that most cardiac arrests in infants and children result from a progression of shock or respiratory failure
• Most recommendations for treatments of poisonings and drug overdose

PALS Provider Course Overview

Lectures and Audiovisual Materials:
Rapid Shock and Cardiopulmonary Assessment
Pediatric Pharmacology
Algorithms
Airway Techniques
Skill Stations may include:
• Advanced Airway Management
• Arrhythmia Recognition
• Bag-Mask Ventilation
• Basic Life Support
• Vascular Access
Whole Group discussions and Optional Topics

- Newly Born
- Trauma and Spinal Immobilization
- Pediatric car seats

Case Scenario Team Practice, learning & Evaluation Stations

- Respiratory Failure
- Rhythm
- Shock
- Unknown
- Vascular Access

Successful Completion Criteria (ASHI PALS certificate of Attendance and card. Valid for 2 years)

- Satisfactory performance in 2 Case Scenario Evaluation Stations
- ≥ 86% correct on Final Written Evaluation
- Proof of current BLS affirmation (must be submitted with registration or taken at course)

The PALS OVERVIEW:

Adoption of International Terminology

- **Tracheal tube** instead of *endotracheal tube*
- **Manual resuscitator** instead of *bag-valve mask*
- **Exhaled CO₂ detection** instead of *end-tidal CO₂ detection*
- **Defibrillation** clarified. “**Shocks** are administered to victims in an attempt to achieve **defibrillation**.”

Ventilation

- Discussion of **endotracheal intubation vs. laryngeal mask airway vs. manual resuscitator**, with an emphasis on intubation and the contention that sufficient skill and experience need to be present to warrant using this technique with children. Skill with the manual resuscitator is mandatory for anyone providing ALS for children and infants.

Fluid Therapy

- Suggests the use of **intraosseous infusions** for children (and adults) older than 6 years old.

Medications

- New information on determining and treating the **cause of arrest**, with considerable material on toxic drug overdose and metabolic derangements.
Treatment of Arrhythmias

- **Vagal maneuvers** are introduced in the SVT discussion
- **Amiodarone** is offered as a Lidocaine alternative treatment for pediatric VT and shock-refractory VF
- **AEDs** may be used for children classes.

Post arrest Stabilization

- Emphasis on *normal ventilation* rather than hyperventilation
- Control of *temperature, management of post ischemic myocardial dysfunction* and *glucose control*

Introduction

"Bystander CPR is provided for only 30% of out-of-hospital pediatric arrests."

Adjuncts for Airway and Ventilation

- Bag-valve-mask ventilation (ventilation bag) is the *primary method of ventilatory support* for prehospital BLS care, particularly if the transport time is short.
- Intubation of pediatric patients in the out-of-hospital setting requires *adequate initial licensed training, ongoing experience, and outcome monitoring.*
- While the LMA (laryngeal mask airway) is a proven, effective adjunct for pediatric ventilation, there are *two concerns* noted in the Guidelines: "An LMA may be more difficult to maintain during patient transport than a tracheal tube." "Furthermore, the LMA is relatively expensive, and a number of sizes are needed...The cost of equipping out-of-hospital providers must be considered."
- *Neonatal (250 ml) ventilation bags should not be used* in ventilation of full-term neonates and infants. Using only the force necessary to *cause the chest to visibly rise*, ventilation bags with a minimum volume of 450-500 ml are preferred.
- *"E-C clamp" technique* for opening the airway and sealing the mask to the face introduced for ventilation bag performance: "The third, fourth and fifth fingers (forming an E) are positioned to lift it forward; then the thumb and index finger (forming a C) hold the mask on the child’s face."
- **Uncuffed/cuffed tracheal tubes** recommended for children younger than 8 years old. Rationale: obstruction to passage of the tube may occur at a point just below the glottis opening.
- A *formula for determining tracheal tube size*: Size (mm) = (age in yrs / 4) + 4, if cuffed, add 3 instead of 4. For tracheal tubes, length-based resuscitation tapes are accurate for children to approximately 35 kg
- **Preparing for endotracheal intubation**, assemble three tracheal tubes: the tube of estimated size, one 0.5 mm larger and one 0.5 mm smaller
- **Interrupt intubation** attempts “if bradycardia develops, the child’s color or perfusion deteriorates, or the oxygen saturation by pulse oximetry falls to an unacceptable level”
- When intubating, *use a small pillow* to achieve “sniffing” position (slight flexion) for children older than 2 years of age. For younger children (<2) and infants, a pillow is not used. Rather, a small roll is often used to elevate the shoulders.
- Two *formulas to estimate appropriate depth of insertion for the tracheal tube*: Depth of insertion (cm) = internal diameter (mm) x 3. Alternative (for children older than 2): Depth of insertion (cm) = (age in yrs/2) + 12
- Regarding exhaled or **end-tidal CO₂ monitoring**: “Six ventilations are recommended to wash out CO₂ that may be present in the stomach and esophagus after bag-valve-mask ventilation. After 6 ventilations, detected CO₂ can be presumed to be from the trachea rather than from a misplaced tube in the esophagus.”
• Also regarding exhaled or end-tidal CO₂ monitoring: Detection of exhaled CO₂ in patients with a perfusing rhythm is both specific and sensitive for tube placement in the trachea (Class IIa), exhaled CO₂ detection is not as useful for patients in cardiac arrest (Class Indeterminate).

• Emphasis on multi-factor confirmation of tracheal tube placement and continuous efforts to ensure preservation of that correct placement.

Establishing and Maintaining Venous Access

• While the preferred site for intraosseous access in children is the proximal anterior tibia, the Guidelines mention the alternative sites of the distal femur, medial malleolus and anterior superior iliac spine. It also takes note that “In older children and adults intraosseous cannulas were successfully inserted into the radius and ulna in addition to the proximal tibia.”

• The Guidelines refine instructions for endotracheal instillation of medications: dilution of the drug with up to 5 ml of normal saline followed by 5 ventilations is equivalent to, and preferred over, delivery of the drug through a catheter or feeding tube threaded though the endotracheal tube.

Drugs Used for Cardiac Arrest Resuscitation

• **Vasopressin** is a Class Indeterminate action. While data supports its use in adult shock-refractory VF, there is inadequate data supporting its use in infants and children.

• “Ionized hypocalcemia is relatively common in critically ill children, particularly those with sepsis.” Accordingly, calcium chloride 10% is discussed. It is preferred over calcium gluconate because of the greater “bioavailability of calcium.”

• Evaluation for hypoglycemia is again addressed, with treatment using 25% glucose and / or 10% glucose boluses. The Guidelines state, however, that hypoglycemia should be treated with continuous infusions when possible, as bolus therapy can cause osmotic diuresis.

• The discussion of sodium bicarbonate is interesting for the notation that while the “dilute solution (4.2%, 0.5 mEq/ml) may be used in neonates to limit the osmotic load, but there is no evidence that the dilute solution is beneficial for older infants and children.”

Rhythm Disturbances

• The Guidelines note that, while the rhythm most commonly recorded in pediatric cardiac arrest is asystole or a brad arrhythmia, approximately 10% of these patients had VF or pulseless VT. This number might be as large as 20% when SIDS patients are excluded. It appears that children older than 9 years of age had significantly more VF than those under 4.

• There are four algorithms in the PALS Guidelines:
  - **Pulseless Arrest** (which combines VF, pulseless VT, PEA and asystole),
  - **Bradycardia**, “Tachycardia for infants and children with rapid rhythm and adequate perfusion”, and “Tachycardia for infants and children with rapid rhythm and evidence of poor perfusion”

• While epinephrine remains the first choice of medication for the treatment of symptomatic pediatric bradycardia, atropine (0.02 mg/kg) is offered as the preferred medication for bradycardia caused by increased vagal tone.

• **Symptomatic bradycardia**, as detailed in the algorithm: “poor perfusion, hypotension, respiratory difficulty, altered consciousness”

• While transthoracic pacing has not been proven effective for pediatric asystole or bradycardia secondary to post arrest hypoxia / ischemia or respiratory failure, the Guidelines note that pacing “may be lifesaving” for “selected cases of bradycardia caused by complete heart block or abnormal function of the sinus node.”
The bradycardia algorithm includes the performance of chest compressions for bradycardia causing severe cardio respiratory compromise (see “symptomatic bradycardia”, above) if, despite oxygenation and ventilation, the infant or child’s heart rate is less than 60 and the infant or child shows evidence of poor systemic perfusion.

Each of the four algorithms emphasizes “Identify and Treat Possible Causes”. Pulseless Arrest and both Tachycardia algorithms use “The 4 H's and 4 T's”:

- Hypovolemia
- Hypoxemia
- Hypothermia
- Hyperkalemia (and other metabolic disturbances)
- Tension Pneumothorax
- Pericardial Tamponade
- Toxins
- Thrombo embolus

“Supraventricular tachycardia (SVT) is the most common non-arrest arrhythmia during childhood and is the most common arrhythmia that produces cardiovascular instability.”

The Guidelines note that while P waves are difficult to identify in childhood tachycardia, P waves in sinus tachycardia will be upright in leads I and aVF, while P waves in SVT will be negative in leads II, III, and aVF.

Vagal maneuvers are introduced as a Class IIa action for the treatment of SVT. Ice water applied to the face for infants and young children is described, as is having the child blow through a straw for a Valsalva maneuver. External ocular pressure is specifically excluded.

“When medications are indicated, adenosine is the drug of choice for SVT in children.” The “two-syringe technique” is described and recommended, with one syringe containing adenosine and the other containing 5-ml of normal saline.

Verapamil for SVT is Class III for infants (refractory hypotension and cardiac arrest), and its use is discouraged in children (hypotension and myocardial depression.)

The use of Amiodarone in children. The drug is a Class IIb action for VT with a pulse and a Class Indeterminate for VF and pulseless VT. Use of the drug in shock-refractory VF and pulseless VT follows one shock, epinephrine and another shock. The recommended dose is 5 mg/kg, rapid IV bolus. For SVT, this same dose (5 mg/kg) is recommended as a loading dose given IV, “over several minutes to 1 hour”. Repeated doses of 5 mg/kg, to a maximum of 15 mg/kg/day can be given.

Lidocaine’s use in VT/VF is now Class Indeterminate. “Although lidocaine has long been recommended for treatment of ventricular arrhythmias in infants and children, data suggests it is not very effective unless the arrhythmia is associated with myocardial ischemia.”

Procainamide is no longer recommended for use in childhood VF and pulseless VT, by virtue of the requirement for administration by slow infusion. Its use in perfusing rhythms, including VT with a pulse, can be considered as a Class IIb action: 15 mg/kg over 30 to 60 minutes, with continuous monitoring of ECG and BP.

The use of vasopressin and high dose epinephrine is addressed briefly as a “vasoconstrictor regimen.” “…high dose (0.1-0.2 mg/kg) may be considered in shock-resistant VF/pulseless VT (Class IIb).” Promising adult data places vasopressin as a Class Indeterminate agent for the same rhythms.

Defibrillation, Cardioversion, and External Pacing

Biphasic AED’s are acceptable
While the one shock, then drug-shock, drug-shock regimen continues for VF and pulseless VT, an alternative is described:

- Three shocks
- Intubation, IV and drug administration, CPR
- Three additional shocks, in succession

Regarding noninvasive (transcutaneous) pacing:

- Not recommended for cardiac arrest (asystole)
- Class IIb for "profound symptomatic bradycardia refractory to BLS and ALS"
- If the child weighs less than 15 kg, pediatric (small or medium) electrodes should be used. "In general, if smaller electrodes are used, the pacer output required to produce capture will be higher."

PALS for the Pediatric Trauma Victim

Regarding intubation in the traumatized victim: "We particularly encourage confirmation of proper tracheal tube placement by use of capnography or exhaled CO2 detection both after intubation and throughout transport (Class IIa)..."

Hyperventilation of pediatric head trauma patients is no longer routinely recommended (Class III)

The E aspect of ABCDE Primary Survey "involves maintenance of a neutral thermal environment - keeping the child warm". It also means "completely examine the child for hidden injuries."

Special Resuscitation Situations

The Guidelines include an extensive and detailed section on Toxicological Emergencies, including:

- Cocaine
- Tricyclic Antidepressants and Other Sodium Channel Blockers
- Calcium Channel Blocker Toxicity
- Beta-Adrenergic Blocker Toxicity
- Opioid Toxicity

Post Resuscitation Stabilization

The Neurological Preservation section includes the following information about hyperthermia and active cooling:

While "recent data suggests that post arrest or post ischemia hypothermia (core temperatures 33 to 36 degrees Centigrade) may have beneficial effects on neurological function." "There is insufficient data, however, to recommend the routine application of hypothermia (Class Indeterminate)

However - Post arrest patients with core temperatures greater than 33 degrees Centigrade and less than 37.5 degrees Centigrade should not be actively rewarmed.

Post arrest patients with core temperatures lower than 33 degrees Centigrade should only be rewarmed to 34 degrees

"In the brain-injured patient or in the post arrest patient with compromised cardiac output, correct hyperthermia to achieve a normal core temperature (Class IIa)"

Family Presence During Resuscitation
The Guidelines offer multiple studies that promote and explain the validity of family presence during resuscitative efforts.

**Termination of Resuscitative Efforts**

"If a child fails to respond to at least 2 doses of epinephrine with a return of spontaneous circulation, the child is unlikely to survive. In the absence of recurring or refractory VF or VT, history of a toxic drug exposure, or a primary hypothermic insult, resuscitative efforts may be discontinued if there is no return of spontaneous circulation despite ALS interventions. In general, this requires no more than 30 minutes."

**Neonatal Resuscitation** - Discussion of room air vs. 100% oxygen during positive pressure ventilation

- Introduction of the laryngeal mask airway (LMA)
- End tidal CO2 detection
- Two thumb technique for chest compressions

"Although 100% oxygen has been used traditionally for rapid reversal of hypoxia, there is biochemical evidence and preliminary clinical evidence to argue for resuscitation with lower oxygen concentrations. Current clinical data, however, is insufficient to justify adopting this practice."

Regarding **laryngeal mask airways** (LMA's): ..." may be an effective alternative for establishing an airway in resuscitation of the newly born infant, especially in the case of ineffective bag-mask ventilation or failed endotracheal intubation (Class Indeterminate. However, we cannot recommend routine use of the laryngeal mask airway at this time, and the device cannot replace endotracheal intubation for meconium suctioning."

Regarding **chest compressions**:

- "Although it is common practice to give compressions if the heart is 60 to 80 bpm and not rising, ventilation should be the priority in resuscitation of the newly born. Provision of chest compressions is likely to compete with provision of effective ventilation." Resolved: Chest compressions if the newly born infant's heart rate falls below 60
- Use the "2 thumb-encircling hands technique"
- Compression depth should be one third the depth of the chest, “but the compression depth must be adequate to produce a pulse.”
- Coordinate compressions and ventilations to avoid simultaneous delivery. 3:1 ratio, 120 events/minute.

**Epinephrine**: High dose is now Class Indeterminate. "The tracheal route of administration may result in a more variable response to epinephrine than the intravenous route; however, neonatal data is insufficient to recommend a higher dose of epinephrine for tracheal administration."

**Discontinuation of resuscitative efforts** may be appropriate if resuscitation of an infant with cardio respiratory arrest does not result in spontaneous circulation in 15 minutes. Resuscitation of newly born infants after 10 minutes of asystole is unlikely to result in survival or survival without disability (Class IIb)"

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**PEDIATRIC ADVANCED LIFE SUPPORT**

**Recommended Guidelines 2010**

Besides incorporating a new approach to teaching advanced life support, the revised PALS course places increased emphasis on special resuscitation circumstances that require immediate intervention (such as hypothermia, anaphylaxis, and electrical injuries) and includes optional teaching modules on such topics as pediatric sedation, children with special healthcare needs (those on home respirators and those with tracheostomy tubes, for
example), coping with death, and toxicology for special circumstances (such as overdoses involving cocaine, tricyclic antidepressants, narcotics, calcium-channel blockers and ß-adrenergic blockers).

It also provides instruction in the use of innovative advanced life support technologies, including exhaled and end-tidal carbon dioxide detectors, the laryngeal mask airway (LMA), and the AED.

In adults, cardiopulmonary arrest is typically sudden and primarily cardiac in origin. In contrast, arrest in children usually follows progressive shock and respiratory failure. Arrest in a young child is most often associated with sudden infant death syndrome, sepsis, or trauma.

Trauma is the most common cause of arrest in children older than 6 months. The success of any advanced life support intervention depends on early recognition of respiratory and circulatory compromise combined with aggressive management of the airway, treatment of rhythm disturbances, and expeditious fluid resuscitation.

**OXYGENATION, VENTILATION AND FLUIDS!**

**Pediatric BLS:**

Trained Pre-Hospital pediatric rescuers should provide approximately 1 minute of BLS before activating the EMS system. In hospital rescuers call the code for unresponsive pediatrics.

*Automated external defibrillators:* Medical evidence indicates that, in nontraumatic arrest, the incidence of ventricular fibrillation is only 3% in children under 8 years, but rises significantly—to 17%—in those older than 9 years. Based on this information, new PALS guidelines approve the use of AED's for assessing heart rhythms and defibrillating children 8 years and older who collapse suddenly outside the hospital. AED's, which have proved to be extremely useful in adults, are conveniently located in many public places (such as airports). They deliver an initial dose of 150 to 200 J, or fewer than 10 J/kg for most children older than 8 years—a dose that is believed to be safe. As previously noted, instruction in the use of an AED is encouraged in BLS training.

There is continued emphasis on the need to provide rescue breaths slowly (1-1.5 second duration) to ensure adequate ventilation and to reduce the likelihood of gastric distention. If breathing is absent, but a pulse is present, rescue breathing should be provided at a rate of 20 breaths/minute (approximately 1 breath every 3 seconds) for the infant or child victim.

In order to simplify the BLS guidelines, the compression rates for infants and children are now virtually identical—100/minute for children and at least 100/minute for infants. With pauses for ventilation, the actual number of compressions provided is at least 80 in one minute. The ratio of compressions to ventilation remains 5:1.

The recommended compression depth of .5-1 inch for the infant and 1-1.5 inches for the child remains unchanged, but is approximate. *Rule of Thumb:* The sternum of the infant or child is compressed approximately 1/3 the depth of the chest.

**Chest compressions should be initiated when the heart rate is less than 80 per minute in an infant or less than 60 per minute in a child.**

**Respiratory Assessment and Airway Management:** *Compensation for Perfusion*

*Airway support* may be provided by means of various airways, a manual resuscitator, endotracheal intubation, or an LMA, depending on the training and skill of the rescuers and the nature and circumstances of the arrest.

There are two types of manual resuscitators (ventilation bags): The self-inflating resuscitator (ambu bag) uses a valve system to fill the bag with oxygen or air following a compression, whereas the flow-inflating bag (anesthesia bag) refills only with oxygen inflow, which must be regulated. A self-inflating bag is easier to use for most medical personnel, but cannot be used to provide supplemental oxygen during spontaneous respiration and provides only room air unless it is connected to an oxygen source. An attached oxygen reservoir enables self-inflating bags to provide as much as a 95% inspired oxygen concentration.
The latest PALS guidelines recommend that the self-inflating bag be used for pediatric resuscitation (the flow-inflating bag can be used as an alternative by properly trained personnel to resuscitate newly born). Rescuers should use a self-inflating bag with a minimum volume of 450 mL for full-term newly born, infants, and children.

Neonatal-sized (250 mL) manual resuscitators are no longer recommended because they may not support effective tidal volume and longer inspiratory times in full-term neonates and infants.

In regard to intubated pediatric patients, the new guidelines recommend confirming tracheal tube placement by using exhaled or end-tidal carbon dioxide detectors. Exhaled carbon dioxide detectors are colorimetric systems that change color if CO$_2$ is produced during exhalation. End-tidal carbon dioxide monitors measure and display the quantity of CO$_2$ at the end of exhalation.

The use of pulse oximetry is encouraged in critically ill infants and children because it enables continuous evaluation of the arterial oxygen saturation.

Pulse oximetry has been successfully used in the pre-hospital as well as the hospital setting. It may provide early indication of respiratory deterioration and development of hypoxemia and should be used during stabilization and transport.

If peripheral perfusion is inadequate (i.e., shock is present, vaspressors used), pulse oximetry is unreliable because accurate readings require the presence of pulsatile blood flow. Care must also be taken to assure proper placement for accurate results.

An end-tidal carbon dioxide detector can enable verification of endotracheal tube placement and displacement in infants larger than 2 kg during stabilization and transport in the pre-hospital and hospital setting.

End-tidal carbon dioxide is negligible in esophageal ET tube placement during resuscitation of the child with no spontaneous circulation.

However, the information provided by end-tidal carbon dioxide monitoring may be misleading because extremely low end-tidal carbon dioxide may indicate either poor cardiac output or esophageal tube placement.

The new guidelines also address the use of the laryngeal mask airway in young children.

The LMA is a tube, with a mask-like projection at the end. It is introduced into the hypopharynx, and a balloon cuff is inflated, securing the distal opening of the tube above the glottic opening. Many believe that an LMA can be inserted more readily than a tracheal tube. ET is still the best airway control.

LMA's do not protect the airway from aspiration, and medications cannot be administered through them. They should not be used in a child with an intact gag reflex.

Intravenous Flush:
Central venous drug administration has been shown to produce more rapid onset of action and higher peak drug levels than peripheral venous administration in adult resuscitation models. However, these differences have not been demonstrated in pediatric resuscitation models and may not be important during pediatric CPR.
Peripheral venous access or intraosseous access provides adequate delivery of fluids and drugs provided that the drugs are flushed into the central circulation (2-5 cc of saline).

Endotracheal Drug Administration:
Endotracheal administration of lipid-soluble resuscitation drugs, including epinephrine, should be provided if vascular access has not been achieved within 3 to 5 minutes. ( NAE ) NARCAN, ATROPINE, EPI

The recommended dose of epinephrine to be administered via endotracheal tube during pediatric resuscitation has been increased to 10 times the intravenous or intraosseous route (0.1 mg/ kg, 1:1000 solution).
Doses of other resuscitation drugs should probably also be increased from the intravenous dose when administered endotracheally, however, the optimal dosage has yet been determined.

When drugs are administered by the endotracheal route, they should be instilled as deeply as possible into the tracheobronchial tree, using a catheter or feeding tube inserted beyond the distal tip of the endotracheal tube. Dilution of the drug into 1 or 2 mL of normal/half-normal saline or LR may aid drug delivery into the peripheral airways.

Optimal doses for epinephrine given by the endotracheal tube in newborns are not known. At present, the same doses of epinephrine for intravenous and endotracheal administration (0.01 to 0.03mg/kg) are recommended. Consideration should be given to using higher doses of 0.1 to 0.2mg/kg of epinephrine by the endotracheal route if intravenous access is not available and the neonate does not respond to standard doses.

**Intraosseous Access:**
In children six years of age or younger, intraosseous access should be established if reliable venous access cannot be achieved within three attempts or 90 seconds. Any fluid or drug that can be administered intravenously, may be administered intraosseous.

**Intravenous Fluids:**
Expansion of circulating blood volume is a critical component of pediatric ALS in children who have sustained trauma with acute blood loss, and it may also be lifesaving in the treatment of non-traumatic shock, such as severe dehydration or septic shock. Early assessment of circulating blood volume is important to prevent progression to refractory shock or cardiac arrest. If the patient in cardiac arrest fails to respond to epinephrine and initial resuscitative efforts, a volume bolus may be considered to rule out hypovolemia.

**Glucose Therapy:**
Infants have high glucose needs and low glycogen stores. As a result, during periods of stress and high energy requirements, the infant may become hypoglycemic. For this reason blood glucose concentrations should be closely monitored during coma, shock, or respiratory failure. Documented hypoglycemia should be treated with an infusion of a glucose-containing solution in a dose of 0.5 to 1.0 g/kg. This can be accomplished with 2-4 mL/kg of 25% glucose solution or 10-20 mL/kg of a 5% glucose solution (D5LR or D5NS).

If possible, hypoglycemia should be treated with a continuous infusion of a glucose-containing solution. Bolus therapy with hypertonic glucose should be avoided because it may result in hyperglycemia, secondary osmotic diuresis, and a potentially worse neurological outcome.

If a bedside glucose determination is not available and clinically the infant is at risk for hypoglycemia, empiric treatment with glucose 0.5 to 1.0 g/kg can be ‘considered’.

**Epinephrine Dosage:**
In cardiac arrest, alpha-adrenergic-mediated vasoconstriction is the most important pharmacologic action of epinephrine because restoration of aortic diastolic pressure is a critical determinant of success or failure of resuscitation.

To manage unresponsive asystolic and pulseless arrest, epinephrine is initially administered intravascularly or intraosseously in a dose of 0.01 mg/kg (0.1 mL/kg of 1:10,000 solution). The latest PALS guidelines recommend the same amount of epinephrine for second and subsequent doses instead of "high-dose" epinephrine. Although high-dose epinephrine is no longer recommended, it still may be considered in refractory arrest situations. High dose not enough studies and is indeterminate.

The epinephrine dose for treatment of bradycardia is 0.01 mg/kg (0.1 cc/kg of 1:10,000 solution) by IV or IO route or 0.1 mg/kg (0.1 cc/kg of 1:1,000 solution) by ET route. The epinephrine dose is not increased as long as the
pulse remains palpable.

The recommended initial resuscitation dose of epinephrine for asystolic or pulseless arrest is 0.01 mg/kg (0.1 cc/kg of 1:10,000 solution) given by the IV or IO route.

Second and subsequent epinephrine doses for unresponsive asystolic and pulseless arrest should be 0.1 mg/kg (0.1 cc/kg of 1:1000 solution).

The higher dose of epinephrine should be administered within 3 to 5 minutes following the initial dose and should be repeated every 3 to 5 minutes during resuscitation. Second and subsequent doses as high as 0.2 mg/kg may be effective.

In newborn resuscitation the recommendation of epinephrine is 0.01 to 0.03 mg/kg and may be repeated every 3 to 5 minutes if required. There are inadequate data to evaluate the efficacy and safety of higher doses of epinephrine in newborns.

**Because this new dosing requires use of two different dilutions of epinephrine, care must be taken to avoid errors in concentration selection and dosing.

In summary, 0.1 cc/kg of the 1:10,000 dilution is used to administer 0.01 mg/kg of epinephrine and 0.1 cc/kg of the 1:1000 dilution is used to administer 0.1 mg/kg of epinephrine. The cc/kg dose remains the same; only the dilution changes.

**New Treatment Protocols:**

New detailed treatment protocols are provided for bradycardia’s, asystole, pulseless electrical activity, and ventricular fibrillation/pulseless ventricular tachycardia.

Amiodarone, in a dose of 5 mg/kg, is now considered the drug of choice for ventricular fibrillation or pulseless ventricular tachycardia unresponsive to three initial defibrillation attempts.

It can also be used to manage hemodynamically stable ventricular tachycardia refractory to cardioversion.

**Treatment of SVT/PSVT:**

Vagal maneuvers have been added to the treatment algorithm for supraventricular tachycardia in children with milder symptoms who are hemodynamically stable. They may also be tried during preparation for cardioversion or drug therapy. Such maneuvers include applying ice water to the face (most effective in infants and young children), carotid sinus massage, and the Valsalva maneuver. External ocular pressure is not recommended. A 12-lead ECG should be obtained before and after performing a vagal maneuver, and the ECG should be monitored continuously during the maneuver.

SVT/PSVT that causes circulatory instability (unstable SVT) is most expeditiously treated with synchronized electrical cardioversion at a starting dose of 0.5 J/kg.

If intravenous access is already available, Adenosine may be administered before cardioversion, but cardioversion should not be delayed while intravenous access is achieved. With continuous ECG monitoring, adenosine 0.1 mg/kg should be given as a rapid intravenous bolus. If there is no effect, the dose may be doubled and repeated. The maximum single dose of adenosine should not exceed 12 mg. Verapamil should not be used in infants and its use is discouraged in children.

**Meconium-Stained Amniotic Fluid:**

Thorough suctioning of the nose, mouth, and posterior pharynx before delivery of the shoulders and thorax should be performed in all neonates having difficulty, with meconium staining, regardless of whether the meconium is thin or thick.
Use of a large-bore (12F or 14F) suction catheter is recommended, although a bulb syringe may be adequate. If the infant is depressed – the meconium is thick or particulate, further suctioning is required immediately after delivery and before performing the usual initial resuscitative steps.

The posterior pharynx should be suctioned. Direct endotracheal suctioning, using the endotracheal tube as a suction catheter, should be performed if the neonate is depressed or the meconium is thick or particulate.

Endotracheal suctioning may not be necessary if the meconium is thin and the newborn is vigorous.

After meconium has been removed by several passes of the tube, if positive pressure ventilation is required, it may be appropriate to leave the endotracheal tube in place. Subsequent suctioning may then be performed by passing a suction catheter through the endotracheal tube. If the baby is severely depressed, the use of positive-pressure ventilation with 100% oxygen should be considered even if some meconium remains in the airway. This addition is based on the need to balance the urgency of establishing a clear airway with the need for oxygenation-ventilation. Personnel should not suction the stomach until after the infant has been fully resuscitated and vital signs are stable.

Resuscitation bags used for ventilation of full-term neonates, infants and children should have a minimum volume of 450 mL.

**Intraosseous access.** The new PALS guidelines have dropped the recommendation to attempt IV access before inserting an intraosseous (IO) line in a pediatric arrest victim. The guidelines now support using an IO line in children older than 6 years in an emergency situation.

**Neonatal Resuscitation - 2005**
Care of the newborn, particularly in the first hours after birth, requires rapid and careful assessment and then focus on initial stabilization, ventilation, and (if needed) chest compressions and administration of epinephrine or volume expansion. The major priority for newborn resuscitation is establishment of effective ventilation and oxygenation. For the 2005 guidelines, additional evidence was available about the use of oxygen versus room air for resuscitation, the need for clearing the airway of meconium, methods of assisting ventilation, techniques for confirming endotracheal tube placement, and use of the LMA.

**Use of Oxygen During Resuscitation**

**2005 (New):** Supplementary oxygen is recommended whenever positive-pressure ventilation is indicated for resuscitation; free-flow oxygen should be administered to babies who are breathing but have central cyanosis (Class Indeterminate). Although the standard approach to resuscitation is to use 100% oxygen, it is reasonable to begin resuscitation with an oxygen concentration of less than 100% or to start with no supplementary oxygen (ie, start with room air). If the clinician begins resuscitation with room air, it is recommended that supplementary oxygen be available to use if there is no appreciable improvement within 90 seconds after birth. In situations where supplementary oxygen is not readily available, positive-pressure ventilation should be administered with room air (Class Indeterminate).

**2000 (Old):** If cyanosis, bradycardia, or other signs of distress were noted in a breathing newborn during stabilization, administration of 100% oxygen was indicated while determining the need for additional intervention. **Why:** Scientists are concerned about the potential adverse effects of 100% oxygen on respiratory physiology and cerebral circulation and the potential tissue damage from oxygen free radicals. Conversely they are also concerned about tissue damage from oxygen deprivation during and after asphyxia. Clinical studies about use of room air or oxygen have yielded contradictory results, and some studies had methodological limitations.

**Clearing the Airway of Meconium**

**2005 (New):** Current recommendations no longer advise routine intrapartum oropharyngeal and nasopharyngeal suctioning for infants born to mothers with meconium staining of amniotic fluid (Class
I). Randomized controlled trials have shown that this practice offers no benefit if the infant is vigorous (Class I). Endotracheal suctioning for infants who are not vigorous should be performed immediately after birth (Class Indeterminate).

2000 (Old): If the amniotic fluid contains meconium and the infant has absent or depressed respirations, decreased muscle tone, or heart rate <100 bpm, perform direct laryngoscopy immediately after birth for suctioning of residual meconium from the hypopharynx and intubation/suction of the trachea. Evidence shows that tracheal suctioning of the vigorous infant with meconium-stained fluid does not improve outcome and may cause complications (Class I).

Why: A 2004 multicenter randomized trial gave further weight to the recommendations.

Devices for Assisting Ventilation

2005 (New): A self-inflating bag, a flow-inflating bag, or a T-piece (a valved mechanical device designed to regulate pressure and limit flow) can be used to ventilate a newborn (Class IIb). Case reports suggest that the LMA can be a reasonable alternative to intubation in special cases, particularly when providers are experienced with the use of the device in preterm infants. Insufficient evidence exists to support the routine use of the LMA as the primary airway device during neonatal resuscitation, in the setting of meconium-stained amniotic fluid, when chest compressions are required, in very low- birth-weight babies, or for delivery of emergency intratracheal medications (Class Indeterminate).

2000 (Old): T-pieces were not discussed in the 2000 guidelines. Evidence was insufficient to recommend for or against the LMA (Class Indeterminate).

Why: T-piece resuscitators are now recognized as acceptable devices for administering positive pressure during resuscitation of the newborn, but personnel should also be familiar with bag-mask equipment and technique.

Indication of Adequate Ventilation and Confirmation of Endotracheal Tube Placement

2005 (New): An increase in heart rate is the primary sign of improved ventilation during resuscitation. Exhaled CO₂ detection is the recommended primary technique to confirm correct endotracheal tube placement when a prompt increase in heart rate does not occur after intubation (Class IIa). Evidence is insufficient to recommend for or against the use of esophageal detector devices.

2000 (Old): The use of exhaled CO₂ detection was thought to be useful in the secondary confirmation of tracheal intubation in the newly born, particularly when clinical assessment was equivocal (Class Indeterminate).

Why: More evidence is available about the reliability of exhaled CO₂ detection to confirm correct placement of endotracheal tubes. The PALS section notes that there is insufficient evidence about the use of esophageal detector devices in patients aged <1 year (weight <20 kg) to recommend their use.

Drug Therapy

2005 (New): The recommended IV epinephrine dose is 0.01 to 0.03 mg/kg per dose. Higher IV doses are not recommended (Class III), and IV administration is the preferred route (Class IIa). While access is being obtained, administration of a higher dose (up to 0.1 mg/kg) through the endotracheal tube may be considered (Class Indeterminate). Naloxone administration is not recommended during the primary steps of resuscitation, and endotracheal naloxone is not recommended (Class Indeterminate). Naloxone should be avoided in babies whose mothers are suspected of having had long-term exposure to opioids (Class Indeterminate).

2000 (Old): The same IV dose of epinephrine was recommended in 2000. Evidence was inadequate to support the routine use of higher doses of epinephrine (Class Indeterminate). Naloxone administration was recommended intravenously, endotracheally, or—if perfusion was adequate—intramuscularly or subcutaneously. In 2000 the tracheal route was the most rapidly accessible.

Why: The prospective randomized trial in pediatrics and the absence of data on effectiveness of high-dose IV epinephrine led to the recommendation that it should not be used in neonates. Because naloxone can be given by many routes and its absorption by the endotracheal route may be unpredictable, this drug should be given by other than endotracheal route.

Temperature Control

2005 (New): Although there is new data (including a second study published in October 2005), the data is insufficient to recommend routine use of modest systemic or selective cerebral hypothermia after resuscitation of infants with suspected asphyxia (Class Indeterminate). Further clinical trials are needed to determine which infants benefit most and which method of cooling is most effective. Avoidance of hyperthermia (elevated body temperature) is particularly important in babies who may have had a hypoxic-ischemic event. Currents Winter 2005-2006
TABLE 3. Applying Classification of Recommendations and Level of Evidence

Currents Winter 2005-2006

Polyethylene bags may help maintain body temperature during resuscitation of very low-birth-weight babies.

**2000 (Old):** In 2000 induced hypothermia was acknowledged as a promising area of research, but evidence was insufficient to recommend routine implementation (Class Indeterminate). The polyethylene bags were not mentioned for temperature control.

**Why:** In a multicenter trial involving newborns with suspected asphyxia (indicated by need for resuscitation at birth, metabolic acidosis, and early encephalopathy), selective head cooling (34°C to 35°C) was associated with a nonsignificant reduction in the overall number of survivors with severe disability at 18 months. The trial showed a significant benefit in the subgroup with moderate encephalopathy. Infants with severe electrographic suppression and seizures did not benefit from treatment with modest hypothermia. A second small controlled pilot study in asphyxiated infants with early induced systemic hypothermia found fewer deaths and disability at 12 months. In October 2005 a third positive study of hypothermia was published. Further data is needed about the technique of induction of hypothermia and support required during the hypothermia. Polyethylene bags have been effective in helping the newborn maintain body temperature.

**Withholding or Withdrawing Therapy**

**2005 (New):** It is possible to identify conditions associated with high mortality and poor outcome in which withholding resuscitative efforts may be considered reasonable, particularly when there has been the opportunity for parental agreement. The following guidelines must be interpreted according to current regional outcomes:

- When gestation, birth weight, or congenital anomalies are associated with almost certain early death and when unacceptably high morbidity is likely among the rare survivors, resuscitation is not indicated (Class IIa). Examples are provided in the guidelines.
- In conditions associated with a high rate of survival and acceptable morbidity, resuscitation is nearly always indicated (Class IIa).
- In conditions associated with uncertain prognosis in which survival is borderline, the morbidity rate is relatively high, and the anticipated burden to the child is high, parental desires concerning initiation of resuscitation should be supported (Class Indeterminate). Infants without signs of life (no heartbeat and no respiratory effort) after 10 minutes of resuscitation show either a high mortality rate or severe neurodevelopmental disability. After 10 minutes of continuous and adequate resuscitative efforts, discontinuation of resuscitation may be justified if there are no signs of life (Class IIb).

**2000 (Old):** Noninitiation or discontinuation of resuscitation in the delivery room maybe appropriate in some circumstances. National and local protocols should dictate the procedures to be followed. Examples were provided in the guidelines of such potential circumstances.

**Information on Neonate Resusitation Procedures**

- Isotonic crystalloid solution (such as normal saline or Ringer's lactate) has replaced 5% albumin as the recommended volume expander.

- Epinephrine is indicated only if the heart rate remains below 60/min after 30 seconds of assisted ventilation with 100% oxygen and an additional 30 seconds of ventilation accompanied by chest compressions. Previously, epinephrine was recommended if the heart rate remained below 80/min despite 30 seconds of ventilation with 100% oxygen and chest compressions or if the heart rate was zero. Other, minor changes in the NRP guidelines include:
  
  - an increase in the rate of free-flow oxygen from 5 L/min to 5 to 10 L/min
  - an increase in the minimum duration of initial ventilation of the newly born from 15 seconds to 30 seconds
  - a decrease in the peak pressure of the initial breath from 40 cm H\(_2\)O to "more than 30 cm" H\(_2\)O
  - an increase from two minutes to "several minutes" of bag-and-mask ventilation before insertion of an orogastric tube.

**Time to retrain**

It is clear that, because of many changes in the 2000 resuscitation guidelines, pediatricians are well advised to enroll in new PALS and NRP courses when they become available. Your local Training Center should be able to provide locations and dates.
Although time to meet all our obligations as pediatricians is often at a premium, maintaining resuscitation skills should have high priority.

**A little on Medication Administration**

Venous administration is the preferred route for drug delivery during advanced life support. However, during cardiovascular collapse, establishing access may be difficult. During neonatal resuscitation, it is recommended that the umbilical vein be used, since it is more easily cannulated than scalp or peripheral veins. In older infants and children, peripheral access is usually more easily established than central access. Regardless of the route used, all doses should be followed by a 5 ml normal saline flush to help move the drug more rapidly into the central circulation.

In patients less than six years of age, an intraosseous (IO) needle may be used if attempts to gain peripheral venous access are not successful. All resuscitation medications, including catecholamines, may be administered into the bone marrow. Intramuscular and sublingual routes of administration are not recommended during resuscitation due to delayed drug delivery. Intracardiac injection is no longer recommended due to the risks of hemopericardium and vessel injury in the face of questionable drug absorption.

Epinephrine, naloxone, atropine, and lidocaine may be given endotracheally (ET) during advanced life support if venous or intraosseous access is unavailable. Studies have shown that for older infants and children, the endotracheal dose of epinephrine should be higher than standard intravenous doses (Table). The optimal dosages of other medications have not been as well established. The current recommendations for naloxone, atropine, and lidocaine in older infants and children are to give two to three times the IV dose. In neonates, epinephrine or naloxone may be administered endotracheally, using the IV dose. The use of higher dosages is not recommended.

To administer medications via the endotracheal tube, the dose should be diluted in 3 to 5 ml of normal saline (1 to 2 ml for neonatal resuscitation) or instilled through a catheter inserted below the end of the endotracheal tube and followed by normal saline. Each dose should be followed by several positive-pressure ventilations using a hand resuscitation bag to ensure drug deposition into the lungs.

**Epinephrine**

Epinephrine is the most frequently used resuscitation medication in infants and children. During cardiac arrest, the primary benefit of epinephrine is its alpha-adrenergic activity, which causes intense vasoconstriction and increases systemic vascular resistance, which improves coronary blood flow. In addition, epinephrine's effects at alpha receptors cause a reduction in blood flow to renal, splanchnic, mucosal, and dermal vascular beds, preserving blood flow to more critical organs. The beta-adrenergic effects of epinephrine cause an increase in cardiac contractility and heart rate, while relaxing smooth muscle.

Epinephrine is used for cardiac arrest (with or without a pulse), asystole, symptomatic bradycardia, and hypotension unrelated to volume depletion. It can be administered every 3 to 5 minutes as needed. The optimal dosage of epinephrine for infants and children during advanced life support remains controversial.

In neonatal resuscitation, epinephrine is given in a dosage of 0.01 to 0.03 mg/kg (0.1 to 0.3 ml/kg of the 1:10,000 solution) IV or ET. Little research has been done to establish optimal dosage ranges during resuscitation in the newborn. At this time, higher doses of epinephrine are not routinely recommended due to concerns over the potential increased risk of intracranial hemorrhage and hypertension.

In pediatric resuscitation, the recommended initial dose of epinephrine is 0.01 mg/kg (0.1 ml/kg of the 1:10,000 solution) IV for bradycardia and cardiac arrest. If pulseless arrest persists, the dose may be increased to 0.1 mg/kg (0.1 ml/kg of the 1:1000 solution). This is the same dose used for endotracheal administration. The use of higher IV doses has been extrapolated from data in adults and in animal models. Results from research in children are mixed. A retrospective study comparing outcomes in children receiving high dose (> 0.1 mg/kg) vs. standard dose (< 0.1 mg/kg) therapy failed to demonstrate any differences in the number of successful resuscitations or in long-term survival.

In pediatric patients with continued hypotension, epinephrine may be given as a continuous infusion (drip). The recommended starting dose is 2 mcg/kg/min, with the infusion rate then reduced to maintain the desired response, usually to 0.1 to 1 mcg/kg/min. Infusion of doses greater than 5 mcg/kg/min may produce profound vasoconstriction at the site of administration.
To calculate an epinephrine drip, a simple formula for children uses 0.6 multiplied by the child’s weight in kg. This amount (in mg) is then added to enough IV solution to equal a total of 100 ml. When the resulting solution is infused at a rate of 1 ml/hr, it will deliver a dosage of 0.1 mcg/kg/min.

**Sodium Bicarbonate**

The development of a mixed metabolic and respiratory acidosis is common during cardiopulmonary arrest as a result of anaerobic metabolism and carbon dioxide retention. Acidosis may cause a decrease in myocardial contractility, lowering of blood pressure, and a blunting of the response to catecholamines. The optimal method to reverse this situation is to provide adequate ventilation and systemic perfusion. Sodium bicarbonate is reserved for severe metabolic acidosis and only when ventilatory support can be assured.

The standard dose of sodium bicarbonate in infants and children is 1 to 2 mEq/kg IV or IO. The use of additional doses (0.5 mEq/kg) should be guided by assessment of laboratory values. Standard solutions of 8.4% (1 mEq/ml) sodium bicarbonate are very hyperosmolar (2,000 mOsm/L) and should be used with caution. In neonates, only the 4.2% (0.5 mEq/ml) solution should be used to avoid increasing the risk of intraventricular hemorrhage. The rate of administration should be no greater than 1 mEq/kg/min.

Sodium bicarbonate should not be given endotracheally, since it can cause substantial tissue injury. It should not be mixed with other medications. Precipitation of calcium and inactivation of catecholamines may occur if they are mixed with sodium bicarbonate.

**Atropine**

Like sodium bicarbonate, the role of atropine in neonatal and pediatric resuscitation has diminished over the past decade. Atropine is a parasympatholytic which reduces vagal tone, increasing atrial pacemaker firing and conduction through the atrioventricular node. It is indicated for the treatment of symptomatic bradycardia, as a second-line therapy after epinephrine. It is also indicated in situations where bradycardia is known to be the result of increased vagal tone (such as during intubation) or in documented atrioventricular block.

In children, the dose of atropine is 0.02 mg/kg IV or IO, with a minimum dose of 0.1 mg to avoid paradoxical bradycardia. The recommended maximum single dose is 0.5 mg for a child and 1 mg for an adolescent or adult. This dose may be repeated once, if no response is seen within 5 minutes.

**Naloxone**

Naloxone is a pure antagonist which reverses the effects of opioids such as morphine and fentanyl. In resuscitations, it is used to reverse the respiratory and central nervous system depression and hypertension caused by administration of opioids. Naloxone is also indicated for severe respiratory depression in neonates whose mothers received opioids within four hours of delivery.

Naloxone acts within 2 to 3 minutes and has a duration of 30 to 60 minutes. The recommended dose for total reversal is 0.1 mg/kg for infants and children up to 5 years of age or 20 kg body weight. Children over 5 years or 20 kg should receive a standard 2 mg dose. Smaller doses may be used if only partial opioid reversal is desired. Naloxone may be administered by rapid IV push, IO, or ET. Intramuscular or subcutaneous administration may result in erratic absorption and reduced efficacy.

Clinicians should be aware of the relatively short duration of action of naloxone compared to many opioids. Repeat dosing is often necessary to avoid recurrence of symptoms of opioid toxicity. Use of naloxone may induce symptoms of abrupt opioid withdrawal (including seizures) in patients receiving chronic therapy or in infants of opioid-addicted mothers. Naloxone is contraindicated in the resuscitation of neonates of mothers with known or suspected drug abuse.

**Calcium Chloride**

Calcium is used in advanced life support to enhance cardiac contractility and increase systemic vascular resistance. Its efficacy in pediatric life support is not clearly established. At this time, calcium administration is recommended only in cases of hypocalcemia, hyperkalemia, hypermagnesemia, and calcium channel blocker overdose. The recommended dose of calcium chloride is 0.2 to 0.25 ml/kg of a 10% solution, to provide 5 to 7 mg/kg elemental calcium (20 to 25 mg/kg calcium salt). This dose should be infused at a rate no faster than 100 mg/min and may be repeated one time. Rapid infusion may result in bradycardia or asystole.
**Dopamine**

In patients who remain hypotensive or poorly perfused after initial resuscitation, a continuous infusion of a catecholamine such as epinephrine, dopamine, or dobutamine should be considered. Dopamine acts at a variety of receptors. At low doses, 2 to 5 mcg/kg/min, dopamine acts primarily on dopaminergic receptors, causing increased renal, coronary, splanchnic, and cerebral blood flow. As the infusion rate is increased above 5 mcg/kg/min, dopamine stimulates beta-adrenergic receptors and increases release of norepinephrine, producing an increase in cardiac contractility. At infusion rates in the range of 10 to 20 mcg/kg/min, dopamine begins to act at alpha-adrenergic receptors, producing vasoconstriction. At these doses, however, dopamine produces significant tachycardia.

Because of its rapid elimination, dopamine can only be administered as a continuous infusion. To calculate a dopamine infusion, multiply the child’s weight in kg by 6. This amount of dopamine (in mg) is then added to enough IV solution to equal a total of 100 ml. When the resulting solution is infused at a rate of 1 ml/hr, it will deliver a dosage of 1 mcg/kg/min.

As with epinephrine, extravasation of dopamine can result in severe tissue necrosis. Administration through a central line is preferred. If extravasation occurs, administration of 2.5 to 5 mg phentolamine intradermally at the IV site may help to reverse the intense vasoconstriction.

**Dobutamine**

Like dopamine, dobutamine stimulates beta-adrenergic receptors and produces a positive inotropic response. It does not, however, act on dopaminergic or alpha-adrenergic receptors. Unlike the vasoconstriction seen with high doses of dopamine, dobutamine produces a mild vasodilatation. It is recommended in cases of cardiogenic or septic shock when the patient is not already hypotensive. Dobutamine is typically started at a dose of 5 mcg/kg/min and titrated to achieve the desired blood pressure response. Dobutamine infusions may be prepared in the same manner as dopamine.

**Adenosine**

Adenosine is a pharmacologic alternative to defibrillation in patients with supraventricular tachycardia. Adenosine produces a transient block of the atrioventricular node. Its short elimination half-life (approximately nine seconds) makes it a safe medication, but also makes it difficult to get adequate drug concentrations at the site of action. The dose for infants and children is 0.1 to 0.2 mg/kg administered by rapid IV push, followed immediately by a 2 to 3 ml normal saline flush. The recommended maximum dose is 12 mg.

**Lidocaine**

Lidocaine plays a less important role in pediatric advanced life support than in adult emergencies. It is used to control ventricular tachycardia or fibrillation. The recommended method of administration is a 1 mg/kg bolus loading dose, followed by a continuous infusion of 20 to 50 mcg/kg/min. The dosage should be reduced in children with low cardiac output or reduced hepatic blood flow or function to avoid lidocaine accumulation. Signs of toxicity include drowsiness, confusion, tremors, and seizures.
**PEDIATRIC ASSESSMENT**

### Airway & Appearance
(Open/Clear – Muscle Tone / Body Position)

- **Abnormal:** Abnormal or absent cry or speech. Decreased response to parents or environmental stimuli. Floppy or rigid muscle tone or not moving.
- **Normal:** Normal cry or speech. Responds to parents or to environmental stimuli such as lights, keys, or toys. Good muscle tone. Moves extremities well.

### General Impression
(First view of patient)

- **Abnormal:** Cyanosis, motting, paleness, pallor or obvious significant bleeding.
- **Normal:** Color appears normal for racial group of child. No significant bleeding.

### Work of Breathing
(VISIBLE MOVEMENT / RESPIRATORY EFFORT)

- **Abnormal:** Increased/excessive (nasal flaring, retractions or abdominal muscle use) or decreased/absent respiratory effort or noisy breathing.
- **Normal:** Breathing appears regular without excessive respiratory muscle effort or audible respiratory sounds.

### Circulation to Skin
(COLOR / OBVIOUS BLEEDING)

- **Abnormal:** Cyanosis, motting, paleness, pallor or obvious significant bleeding.
- **Normal:** Color appears normal for racial group of child. No significant bleeding.

### Decision/Action Points:
- Any abnormal findings or life-threatening chief complaint such as major trauma/burns, seizures, diabetes, asthma attack, airway obstruction, etc (urgent) – proceed to initial assessment.
- All findings normal (non-urgent) – proceed to initial assessment.

### Initial Assessment
(Primary Survey)

- **Abnormal:** Obstruction to airflow. Gurgling, stridor or noisy breathing. Verbal, Pain, or Unresponsive on AVPU scale.
- **Normal:** Clear and maintainable. Alert on AVPU scale.

### Breathing
(Effort / Sounds / Rate / Central Color)

- **Abnormal:** Presence of retractions, nasal flaring, stridor, wheezes, grunting, gurgling or gurgling. Respiratory rate outside normal range. Central cyanosis.
- **Normal:** Easy, quiet respirations. Respiratory rate within normal range. No central cyanosis.

### Circulation
(Pulse Rate & Strength / Extremity Color & Temperature / Capillary Refill / Blood Pressure)

- **Abnormal:** Cyanosis, motting, or pallor. Absent or weak peripheral or central pulses. Pulse or systolic BP outside normal range. Capillary refill > 2 sec with other abnormal findings.
- **Normal:** Color normal. Capillary refill at palms, soles, forehead or central body ≤2 sec. Strong peripheral and central pulses with regular rhythm.

### Decision/Action Points:
- Any abnormal finding (C, U, or P) –
  - Check for causes such as diabetes, poisoning, trauma, seizure, etc. Assist patient with prescribed bronchodilators or epinephrine auto-injector, if appropriate.
- All findings on assessment of child normal (S) – Continue assessment, detailed history & treatment.

### Normal Respiratory Rates:
- **Infant (<1yr):** 30-60
- **Toddler (1-3yr):** 24-40
- **Preschooler (4-5yr):** 22-34
- **School-age (6-12yr):** 18-30
- **Adolescent (13-18yr):** 12-20

### Normal Pulse Rate:
- **Infant:** 100-160
- **Toddler:** 90-150
- **Preschooler:** 80-140
- **School-age:** 70-120
- **Adolescent:** 60-100

- Pulsess slower in sleeping child/athlete

### Lower Limit of Normal Systolic BP:
- **Infant:** >60 (or strong pulses)
- **Toddler:** >70 (or strong pulses)
- **Preschooler:** >75
- **School-age:** >80
- **Adolescent:** >90

- Estimated min. SBP = 70 + (2 x age in yr)
Pediatric CUPS (with examples)

**Critical**
- Absent airway, breathing or circulation (cardiac or respiratory arrest or severe traumatic injury)

**Unstable**
- Compromised airway, breathing or circulation (unresponsive, respiratory distress, active bleeding, shock, active seizure, significant injury, shock, near-drowning, etc.)

**Potentially Unstable**
- Normal airway, breathing & circulation but significant mechanism of injury or illness (post-seizure, minor fractures, infant < 3mo with fever, etc.)

**Stable**
- Normal airway, breathing & circulation
  - No significant mechanism of injury or illness (small lacerations or abrasions, infant <24mo with fever)

Glasgow Coma Score

<table>
<thead>
<tr>
<th>Infants</th>
<th>Children / Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Opening</strong></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>4</td>
</tr>
<tr>
<td>To speech/sound</td>
<td>3</td>
</tr>
<tr>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td><strong>Verbal Response</strong></td>
<td></td>
</tr>
<tr>
<td>Coos or hiccups</td>
<td>5</td>
</tr>
<tr>
<td>Irritable crying</td>
<td>4</td>
</tr>
<tr>
<td>Cries to pain</td>
<td>3</td>
</tr>
<tr>
<td>Means to pain</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td><strong>Motor Response</strong></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>6</td>
</tr>
<tr>
<td>Withdraws touch</td>
<td>5</td>
</tr>
<tr>
<td>Withdraws pain</td>
<td>4</td>
</tr>
<tr>
<td>Abnormal flexion</td>
<td>3</td>
</tr>
<tr>
<td>Abnormal extension</td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
</tr>
</tbody>
</table>

Neonatal Resuscitation

- Dry, Warm, Position, Tactile Stimulation.
- Suction Mouth then Nose.
- Call for ALS back-up. Administer O₂ as needed.
- Apnea/Gasping. HR <100 or central cyanosis

Ventilate with BVM @ 40-60/min.

**HR<60 after 30 sec BVM**

Chest Compressions @ 120/min - 3:1
1/3 to 1/2 chest depth
2 thumb encircle chest or 2 fingers

**ALS available & HR<60**

Intubate
Epinephrine 0.01-0.03mg/kg
IV/OET 1:10,000
q 3-5 min

Respiratory / Cardiac Arrest Treatment

<table>
<thead>
<tr>
<th>Infant &lt;1yr</th>
<th>Child 1-8yr</th>
<th>Teen 9-18yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation only</td>
<td>12-20 bpm</td>
<td>12-20 bpm</td>
</tr>
<tr>
<td>CPR method</td>
<td>2 fingers</td>
<td>1 hand</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>1/3-1/2 of the depth of the chest</td>
<td></td>
</tr>
<tr>
<td>Compression Rate</td>
<td>100/min</td>
<td>100/min</td>
</tr>
<tr>
<td>Ratio</td>
<td>30:2/15:2</td>
<td>30:2/15:2</td>
</tr>
</tbody>
</table>

CPR should be started for HR<60.
AED should be used on patients ≥1-8 yr of age (with energy reducer).

APGAR Score

<table>
<thead>
<tr>
<th>0 pts</th>
<th>1 pt</th>
<th>2 pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>Absent</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Resp</td>
<td>Absent</td>
<td>Slow/Regular</td>
</tr>
<tr>
<td>Tone</td>
<td>Limp</td>
<td>Some flexion</td>
</tr>
<tr>
<td>Reflex</td>
<td>None</td>
<td>Grin/ Sneeze</td>
</tr>
<tr>
<td>Color</td>
<td>Blue</td>
<td>Pink/Breath</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>All Pink</td>
</tr>
</tbody>
</table>

PALS

**Guidelines**

**Asystole or PEA**
- Assess airway & start CPR
- Intubate & ventilate with oxygen
- Epinephrine 0.01mg/kg 1:10,000 IV/OET
- 0.1mg/kg 1:1000 ET
- Continue Epinephrine q 3-5 min, same dose
- Consider high dose 0.1mg/kg 1:1000 IV/OET
- Consider possibility of hypoxia, hypervolemia, hypoalbuminemia, hyper/hypokalemia, tamponade, tension pneumothorax, toxins/poisons/drugs or thromboembolism & treat if present.

**Bradycardia**
- Assess airway & give oxygen
- Intubate if decreased consciousness
- Start CPR if HR<60.
- Epinephrine 0.01mg/kg 1:10,000 IV/OET
- 0.1mg/kg 1:1000 ET
- Continue Epinephrine q 3-5 min, same dose
- Atropine 0.02mg/kg IV/OET, minimum dose 0.1mg maximum dose 0.5mg child; 1.0mg teen

**VF or pulseless VT**
- Assess airway & start CPR
- Defibrillate at 2j/kg
- Start CPR, intubate, ventilate with O₂
- Epinephrine 0.01mg/kg 1:10,000 IV/OET
- 0.1mg/kg 1:1000 ET
- Defibrillate 4j/kg
- Amiodarone 5mg/kg IV/OET or
- Lidocaine 1mg/kg IV/OET or
- Magnesium 25-50mg/kg IV/OET
(for torsades de pointes or hypomagnesemia)
- Defibrillate 4j/kg
**PEDIATRIC PULSELESS ARREST ALGORITHM**

**BLSL Algorithm, PPE, Safety, LOC, Call for help, GIVE CPR, When available: Adv Airway, IV, Attach Monitor/defibrillator/AED - Coma of Unknown Origin**

**Shockable**

**VF/ Pulseless VT**

- **GO TO VF/Pulseless VT**
- **ASYSTOLE PEA**

**Assess Rhythm**

- **NOT Shockable**

**ASYSTOLE PEA**

- **NO PULSE**
  - **GO TO ASYSTOLE/PEA**

**PT HAS PULSE:**

- **Begin Post-resusitation care**

**During CPR**

- **Push Hard and Fast**
- **Minimize stops in Compressions**
  - 15:2; 5 cycles=1-2 min
- **Avoid hyperventilation**
- **Secure Airway**;
- **Confirm placement**
- **Advanced Airway use continuous Compressions without pauses 8-10 bm**
- **Check rhythm q 2 min**

**Ensure Rise and Recoil Rule out Possible causes:**

- Hypothermia
- Hypoxia
- Hydrogen Ion (acidosis)
- hypo/hyperkalemia
- Hypoglycemia
- Toxins
- Tamponade, Cardiac
- Tension pneumothorax
- Thrombus
- Trauma

**BLS Algorithm, PPE, Safety, LOC, Call for help, GIVE CPR, When available: Adv Airway, IV, Attach Monitor/defibrillator/AED - Coma of Unknown Origin**
PULSELESS ARREST TREATMENT

Always consider as causes to rule out:
Coma of Unknown origin:
   Narcan, Accuchek, Thiamin
Anaphylactic Shock:
Epi 1:1000 ampule, Benedryl, and NOTHING PO
**ADEQUATE Perfusion**
Support ABC’s
Observe and Monitor
Consider Expert Consult

**PPE, Safety, BLS Assessment**

- **LOC**
  - Maintain Airway
  - Give Oxygen: NRB, Oxygen, 10-15L = 90-100%
- Attach/view Monitor and Identify Rhythm, BP, Pulse Oximetry
- Establish patent IV access
- Coma of Unknown Origin

**If Pulseless at any time, GO TO Pulseless Arrest Algorithm**
Use hard and fast CPR (100 min)

**Rule out Possible causes:**
- Hypothermia
- Hypoxia
- Hydrogen Ion (acidosis)
- Hypo/hyperkalemia
- Hypoglycemia
- Toxins
- Tamponade, Cardiac
- Tension pneumothorax
- Thrombus
- Trauma

**Rate Causing Cardio-respiratory Compromise**
< 60 bpm and Symtomatic

**Brady/ Rate STILL Causing Cardio-respiratory compromise**
Signs and Symptoms caused by the RATE
Decreased LOC, Chest pain, Hypotension, or signs of shock (Lack of PERFUSION)

**INADEQUATE PERFUSION**
PERFORM CPR if despite oxygenation and ventilation HR remains <60bpm

**STILL SYMPTOMATIC BRADYCARDIA?**

**INADEQUATE PERFUSION**
Give:
- **EPINEPHRINE:**
  - IV/IO 0.01 mg/kg, 1:10,000 Sol; 0.1 mL/kg
  - ET - 0.1 mg/kg, 1:1,000 Sol; 0.1 mL/kg
- If Suspected Vagal or AV Block:
  - **ATROPINE:** IV/IO, 0.02mg/kg; may repeat MAX for child: 1 mg
- If ineffective, consider PACING.
  - TCP (Transcutaneous Pacing)
  - NO DELAY for 2nd and 3rd degree AV Block

**Prepare for TCP (Transcutaneous Pacing)**
Treat contributing Causes
Acquire Expert Consultation
PEDIATRIC TACHYCARDIA ALGORITHM
WITH A PULSE, BUT POOR PREFUSION

PPE, Safety, BLS Assessment
LOC, Maintain Airway, Give Oxygen: NRB, 10-15L = 90-100%, Monitor ECG and Identify Rhythm, BP, Pulse Oximetry, Establish IV access, Identify and Treat causes

Still Symptomatic?

NARROW QRS
Obtain 12 lead ECG
Expert Consult

YES
Patient Stable?
Coma of Unknown Origin
< LOC, Chest pain, <BP, Shock, rate

NO

IRREGULAR QRS:
Consider: Vagal Maneuvers (no delay)
Give: ADENOSINE: 6mg, rapid IV push, 1-2 min, 12 mg, rapid IV push 1 time
Or:
Go to Synchronized Cardioversion

EXPERT CONSULT
Avoid AV Blockers,
Consider Antiarrhythmics:
Amiodarone: 5mg/kg IV over 20-60 min
or
Procainamide: 15mg/kg IV over 30-60 min

WIDE QRS
Possible V-Tach/Unstable
Synchronized Cardioversion
0.5-1J/kg, then to 2J/kg
Sedation, if possible, if Patient alert; W/O DELAY, Expert Consult
May attempt Adenosine if SEC is not delayed

REG PR/IRREGULAR RR
Infant usually: <220 bpm
Child usually: <180 bpm
History
P present and normal

Search for and treat causes

At any time Patient becomes UNSTABLE
go to Synchronized Cardioversion

IRREGULAR QRS:
Consider: Vagal Maneuvers (no delay)
Give: ADENOSINE: 6mg, rapid IV push, 1-2 min, 12 mg, rapid IV push 1 time
Or:
Go to Synchronized Cardioversion

During Evaluation
Secure, Verify airway and IV, Consider Expert Consult, Prepare for Cardioversion
Rule out Possible causes:
- Hypothermia
- Hypoxia
- Hydrogen Ion (acidosis)
- Hypo/hyperkalemia
- Hypoglycemia
- Toxins
- Tamponade, Cardiac
- Tension pneumothorax
- Thrombus
- Trauma
ILCOR/ International PALS 2010 Guidelines

PEDIATRIC TACHYCARDIA ALGORITHM

Good Perfusion WITH A PULSE Poor Perfusion

PPE, Safety, BLS Assessment
LOC, Maintain Airway, Give Oxygen: NRB, 10-15L = 90-100%, Monitor ECG and Identify Rhythm, BP, Pulse Oximetry, Establish IV access, Identify and Treat causes

Still Symptomatic?

NARROW QRS
Obtain 12 lead ECG
Expert Consult

YES Patient Stable? NO
Coma of Unknown Origin
< LOC, Chest pain, < BP, Shock, rate

WIDE QRS
Possible V-Tach/Unstable
Synchronized Cardioversion
0.5-1J/kg, then to 2J/kg
Sedation, if possible, if Patient alert; W/O DELAY, Expert Consult
May attempt Adenosine if SEC is not delayed

EXPERT CONSULT
Avoid AV Blockers,
Consider Anitarrhythmics:
Amiodarone: 5mg/kg IV
over 20-60min
or
Procainamide: 15mg/kg IV
over 30-60 min

NARROW QRS
Regular Sinus Tach
Irregular PSVT

REG PR/IRREGULAR RR
Infant usually: <220 bpm
Child usually: <180 bpm
History
P present and normal

Search for and treat causes

IRREGULAR QRS:
Consider: Vagal Maneuvers (no delay)
Give: ADENOSINE: 6mg, rapid IV push,
1-2 min, 12 mg, rapid IV push
1 time
Or:
Go to Synchronized Cardioversion

At any time Patient becomes UNSTABLE go to Synchronized Cardioversion

During Evaluation
Secure, Verify airway and IV, Consider Expert Consult, Prepare for Cardioversion
Rule out Possible causes:
- Hypothermia
- Hypoxia
- Hydrogen Ion (acidosis)
- Hypo/hyperkalemia
- Hypoglycemia
- Toxins
- Tamponade, Cardiac
- Tension pneumothorax
- Thrombus
- Trauma

PALS GCE Study Supplement 44
Recognize Decreased LOC and PERFUSION
Oxygenation, Ventilation, Fluids per guidelines.
LOC, Maintain Airway, Give Oxygen: NRB, 10-15L = 90-100%, Monitor ECG and Identify Rhythm, BP, Pulse Oximetry, Establish IV access, Identify and Treat causes. Consider: ABG, glucose, lactate, ionized calcium, cultures, CBC

First HOUR: Repeated fluid bolus 20mL/kg based on patient response
Consider other therapies:
Correct Hypoglycemia, hypocalcemia
Admin antibiotics STAT
Vasopressor drip or stress dose hydrocortisone

FLUID RESPONSIVE
Normal BP, with increased LOC and/or perfusion
YES

FLUID RESPONSIVE
Normal BP, with increased LOC and/or perfusion
NO

Evaluate O2 sat >70%?

Sat >70%, low BP
‘warm shock’
More fluid boluses
Norepinephrine and / or Vasopressors

Sat <70%, Normal BP
Poor Perfusion
Transfuse to Hgb >10g/dl
Optimize arterial O2 sat.
More fluid boluses
Consider:
Nitroprusside or Milrinone
Dobutamine

Sat <70%, Low BP
Poor perfusion ‘cold shock’
Transfuse to Hgb >10g/dl
Optimize arterial O2 sat.
More fluid boluses
Consider:
Epinephrine or Dobutamine + Norepi

NOTE: All above can define patient risk for adrenal insufficiency
Draw baseline cortisol, if unsure
Consider ACTH stimulation test if unsure of need for steroids
If adrenal insufficiency present give:
HYDROCORTISONE: 2 mg/ kg bolus IV; max. 100mg
Approach to fluid resuscitation in a child with multiple injuries

Signs of inadequate systemic perfusion are present.
*In a child with severe trauma and life threatening blood loss:
  Need blood for type set and cross match.
  Use O-neg for Female or Male
  Use O-Pos for Males only

Rapid infusion <20 min: 20 mL/kg, LR or NS

Continued signs of inadequate perfusion?
  YES

2\textsuperscript{nd} Rapid infusion <20 min:
  20 mL/kg, LR or NS

Continued signs of inadequate perfusion?
  YES

3\textsuperscript{rd} Rapid infusion <20 min:
  20 mL/kg, LR or NS
  or
  Packed RBC's: 10mL/kg, mix in NS Bolus
  Repeat q 20-30 min PRN
POST-ARREST TREATMENT ALGORITHM

Post-arrest Stabilization

Post-arrest Shock

Fluid Bolus: 10-20 mL/kg, LR or NS
Monitor Response

Reassess signs of Shock?
YES

Measure BP?

Hypotensive Shock?

Consider more fluid boluses
Epinephrine: 0.1-1 µg/min, titrate
Dobutamine: 2-20 µg/kg/min
AND/OR
Dopamine: 10-20 µg/min, titrate
AND/OR
Norepinephrine: 0.2-2 µg/min, titrate

Normotensive Shock?

Consider more Fluid Boluses
Dobutamine: 2-20 µg/kg/min
AND/OR
Dopamine: 2-20 µg/kg/min
AND/OR
Epinephrine: LOW DOSE
0.05-0.3 µg/kg/min
AND/OR
Inamrinone:
Loading 0.75-1 mg/kg/5 min,
may repeat up to 3mg/kg
Infusion: 5-10 µg/kg/min
AND/OR
Milrinone:
Loading 50-75 µg/kg/10-60 min
Infusion: 0.5-0.75 µg/kg/min
Synchronized Cardioversion Algorithm

**Steps for Synchronized Cardioversion**

1. **Consider sedation.**
2. Turn on defibrillator (monophasic or biphasic).
3. Attach monitor leads to the patient (“white to right, red to ribs, what’s left over to the left shoulder”) and ensure proper display of the patient’s rhythm.
4. **Engage the synchronization mode by pressing the “sync” control button.**
5. Look for markers on R waves indicating sync mode.
6. If necessary, adjust monitor gain until sync markers occur with each R wave.
7. Select appropriate energy level.
8. Position conductor pads on patient (or apply gel to paddies).
10. Announce to team members: “Charging defibrillator – stand clear!”
11. Press “charge” button on apex paddle (right hand).
12. When the defibrillator a charged, begin the final clearing chant. State firmly in a forceful voice the following chant before each shock:
   
   “I am going to shock on three. One, I’m clear.” (Check to make sure you is clear of contact with the patient, the stretcher and the equipment.)
   
   “Two, you are clear” (Make a visual check to ensure that no one continues to touch the patient or stretcher. In particular, do not forget about the person providing ventilations. That person’s hands should not be touching the ventilatory adjuncts, including the tracheal tube!) “Three, everybody’s clear” (Check yourself one more time before pressing the “shock” buttons.)
13. Apply approx. 25lb pressure on both paddles and don’t touch the patient with your body!
14. Press the “discharge” buttons simultaneously.
15. Check the monitor. If tachycardia persists, increase the joules according to the electrical cardioversion algorithm.
16. Reset the sync mode after each synchronized cardioversion because most defibrillators default back to unsynchronized mode. This default allows an immediate defibrillation if the cardioversion produces VF.

**Tachycardia**

(With serious signs and symptoms related to the tachycardia)

*If ventricular rate is >150 bpm, prepare for immediate cardioversion.* May give brief trail of medications based on specific arrhythmias. Immediate cardioversion is generally not needed if heart rate is <150 bpm.

<table>
<thead>
<tr>
<th>Have available at bedside:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen saturation monitor</td>
</tr>
<tr>
<td>✗ Suction device, IV line</td>
</tr>
<tr>
<td>✗ Intubation equipment</td>
</tr>
</tbody>
</table>

**Premedicate whenever possible**

- Synchronized Cardioversion
  - Ventricular tachycardia
  - Paroxysmal Supraventricular Tachycardia
  - Atrial fibrillation
  - Atrial flutter: 50J, 100J, 200J, 300J, 360J
  - monophasic energy dose 150-200J

**Note:**

1. Effective regimens have included a sedative (diazepam, midazolam, barbiturates, etomidate, ketamine, methochexital) with or without an analgesic agent (e.g., fentanyl, morphine, medperidine). Many experts recommend anesthesia if service is readily available.
2. Both monophasic and biphasic waveforms are acceptable if documented as clinically equivalent to reports of monophasic shock success.
3. Note possible need to resynchronize after each cardioversion.
4. If delays in synchronization occur and clinical condition is critical, go immediately to unsynchronized shocks.
5. Treat poly ventricular tachycardia (irregular form and rate) like ventricular fibrillation: see ventricular fibrillation/pulseless ventricular tachycardia algorithm.
6. Paroxysmal supraventricular tachycardia and atrial flutter often respond to lower energy levels (start with 50J).
**Initial therapy for all patients**

- Remove wet garments
- Protect against heat loss and wind chill
  (Use blankets and insulating equipment)
- Maintain horizontal position
- Avoid rough movement and excess activity
- Monitor core temperature
- Monitor cardiac rhythm

**ABC’s - Assess LOC - ABC’s**

**No drugs until rewarmed**

---

**Pulse; breathing present**

- 34°C to 36°C (94-96°F mild hypothermia)
  - Passive rewarming
  - Active external rewarming

- 30°C to 34°C (86-94°F moderate hypothermia)
  - Passive rewarming
  - Active external rewarming of truncal areas only 1,3

**Active internal rewarming 2**

- Warm IV fluids (109°F-43°C)
- Peritoneal lavage (KCl-free fluid)
- Extra corporeal rewarming
- Esophageal rewarming tubes 4

**Continue internal rewarming until**

- Core temperature > 35°C (95°F)
- Return of spontaneous circulation or
  Resuscitative efforts cease

---

**Pulse; breathing absent**

- Start CPR - CAB
- Defibrillate VF/pulseless VT up to a maximum of 3 shocks; Max on Mono or Biphasic; per AED; see VF/VT algorithm and AED algorithm)
- Attempt, confirm, secure airway
- Ventilate with warm, humid oxygen (42°C to 46°C/107-115°F) 2
- Establish IV access
- Infuse warm normal saline (43°C-109°F) 2

---

**What is core temperature?**

**Coma of Unknown Origin**

- <30°C (86°F severe hypothermia)
  - Active internal rewarming sequence (see below)

- 34°C to 36°C (94-96°F mild hypothermia)
  - Passive rewarming
  - Active external rewarming

- 30°C to 34°C (86-94°F moderate hypothermia)
  - Passive rewarming
  - Active external rewarming of truncal areas only 1,3

- <30°C (86°F severe hypothermia)
  - Active internal rewarming sequence (see below)

**Active internal rewarming 2**

- Warm IV fluids (109°F-43°C)
- Peritoneal lavage (KCl-free fluid)
- Extra corporeal rewarming
- Esophageal rewarming tubes 4

**Continue internal rewarming until**

- Core temperature > 35°C (95°F)
- Return of spontaneous circulation or
  Resuscitative efforts cease

---

**Note:**

- This may require needle electrodes through the skin.
- Many experts think these interventions should be done only in-hospital, though practice varies.
- Methods include electric or charcoal warming devices, hot water bottles, heating pads, radiant heat sources and warming beds.
- Esophageal rewarming tubes are widely used internationally and are expected to become available in the United States.
The Heart and 12 Lead ECG
**First Impression**
Clear of meconium?
Breathing or crying?
Good muscle tone?
Color pink?
Term gestation?

- Provide warmth
- Position
- Clear airway as necessary*
- Dry, stimulate, reposition
- Give O₂ as necessary

**Breathing effectively?**
HR > 100 and pink?

**Supportive care**

**Routine care**
- Warm
- Clear airway
- Dry

**Evaluate**
Assess
- Respiration
- Heart rate
- Color

**Evaluate**
Apnea or HR < 100?

- Provide positive-pressure ventilation*

**Evaluate**
HR < 60

- Provide positive-pressure ventilation*
- Administer chest compressions

**Evaluate**
HR < 60

- Administer Epinephrine*
  0.01 to 0.03 mg/kg
  (0.1 to 0.3 mL/kg of a 1:10 000 solution)

*Tracheal intubation may be considered at several steps.*
1. Which of the following lists conditions that affect the upper airway?
   a. Bacterial tracheitis, epiglottitis, bronchiolitis
   b. Bronchiolitis, croup, asthma
   c. Asthma, bronchiolitis, pneumonia
   d. Croup, epiglottitis, bacterial tracheitis

2. Systemic complications of vascular access include:
   a. Phlebitis
   b. Cellulitis
   c. Hematoma formation
   d. Catheter-fragment embolism.

3. A child with signs of cyanosis, diminished breath sounds with minimal chest excursion, and an inadequate respiratory rate is exhibiting signs of:
   a. Hypothermia
   b. Hypovolemia
   c. Respiratory failure
   d. Early respiratory distress

4. In the pediatric patient, cardiac arrest is most often due to:
   a. Hypothermia
   b. Acid-base imbalance
   c. Respiratory failure
   d. Sepsis

5. For which of the following conditions is calcium administration appropriate?
   a. Hypoglycemia
   b. Supraventricular tachycardia
   c. Hyperkalemia
   d. Tricyclic antidepressant overdose

6. The tracheal dose of epinephrine is for an infant or child is:
   a. 0.1 mg/kg (0.1 mL/kg) of 1:1000 solution
   b. 0.01 mg/kg (0.1 mL/kg) of 1:10,000 solution
   c. 0.02 mg/kg of 1:100 solution
   d. 0.04 mg/kg of 1:10,000 solution

7. Suctioning of the newly born infant should be limited to ___ per attempt.
   a. 3 to 5 seconds
   b. 5 to 10 seconds
   c. 10 to 15 seconds
   d. 15 to 30 seconds
8. The peak incidence of sudden infant death syndrome occurs at age:
   a. 1 to 2 months  
   b. 2 to 4 months  
   c. 6 to 8 months  
   d. 10 to 12 months

9. Paramedics are called to a private residence for a 6-month-old infant with difficulty breathing. Upon arrival, the infant’s mother is frantic. Mom states she went to check on the napping infant and found him blue and not breathing. She picked up the infant and ran to the phone to call 9-1-1. The infant began spontaneously breathing while she was on the phone. You find the infant awake and alert with normal color and vital signs for age. Mom is uncertain if her baby requires transport to the hospital. Your best course of action will be to:
   a. Allow the mother to refuse further care. The infant is in no obvious distress at this time.  
   b. Contact Child Protective Services.  
   c. Explain your concerns regarding the infant’s reported color change and apneic episode and encourage the mother to permit transport for physician evaluation.  
   d. Remain on the scene until the mother has made a follow-up appointment with the infant’s pediatrician.

10. Select the incorrect statement regarding human poisoning exposures reported to American Poison Control Centers in 2002.
   a. Most poisoning exposures involve children < 6 years of age.  
   b. Death due to unintentional poisoning in young children is common.  
   c. The majority of pediatric toxic exposures are intentional.  
   d. Cosmetics and personal care products are the substances most frequently involved in pediatric exposures involving children < 6 years.

Questions 11 through 18 refer to the following scenario.

An apneic and pulseless 6-year-old boy is brought by ambulance to the Emergency Department. EMT-Basics report the child was the front-seat passenger of a vehicle involved in a rollover crash. The child was not restrained. Examination confirms the child is apneic and pulseless with contusions noted on the anterior chest and open fractures of both femurs. Chest compressions are being performed and the child is being ventilated with 100% with a bag-valve-device.

11. Positive-pressure ventilation should be provided at a rate of:
   a. 8 to 12 breaths/minute.  
   b. 12 breaths/minute.  
   c. 14 to 20 breaths/minute.  
   d. 20 breaths/minute.
The cardiac monitor has been applied and reveals the following rhythm:

![EKG Image]

12. The rhythm displayed is:
   a. Bradycardia
   b. Ventricular fibrillation
   c. Sinus tachycardia
   d. Supraventricular tachycardia

13. Despite the rhythm observed on the cardiac monitor, the child is unresponsive, apneic, and pulseless. This clinical situation is called:
   a. Asystole.
   b. Ventricular fibrillation.
   c. Pulseless electrical activity.
   d. Pulseless ventricular tachycardia.

14. List five possible reversible causes of this clinical situation. H&T
   a.
   b.
   c.
   d.
   e.

15. In addition to other injuries, physical examination of this child revealed anterior chest contusions. Select the correct statement regarding thoracic trauma and the pediatric patient.
   a. Children are more likely to sustain rib fractures than adults are.
   b. A pulmonary contusion/laceration is the most common thoracic injury seen in children.
   c. Thoracic trauma in children is associated with a low mortality rate.
   d. A pulmonary contusion is a life-threatening injury that is readily recognized in the pediatric trauma patient.

16. A first-line medication used in the management of this clinical situation is:
   a. Atropine
   b. Dopamine
   c. Epinephrine
   d. Sodium bicarbonate

17. The first-line medication given in the management of this clinical situation is used to:
   a. Decrease myocardial contractility.
   b. Increase systemic vascular resistance.
   c. Decrease heart rate.
   d. Increase myocardial irritability.
18. Despite the interventions performed thus far, the child’s cardiac rhythm remains unchanged. A pulse is not present. Should defibrillation be performed? Y N

19. Which of the following statements is true regarding the use of the Glasgow Coma Scale (GCS)?
   a. The GCS is used to assess the patient’s verbal response, motor response, and pupillary reactivity.
   b. When assigning a score using the GCS, the maximum possible score is 13.
   c. When using the GCS, the minimum possible score is 3.
   d. The GCS is used to assess the patient’s verbal response, motor response, and capillary refill.

20. Pediatric rhythm disturbances may be categorized as normal for age, fast, slow, or absent/pulseless. List three examples of rhythm disturbances found in the absent/pulseless rhythm category.
   a.
   b.
   c.

21. Which of the following formulas may be used to approximate the correct tracheal tube size in a child?
   a. Age in years/2 + 12
   b. 70 + (2 x age in years)
   c. 16 + age in years/4
   d. 90 + (2 x age in years)

22. A 5-year-old girl is unresponsive, apneic, and pulseless. The child is being ventilated with a bag-valve-mask and 100% oxygen. Chest compressions are being performed. The cardiac monitor reveals ventricular fibrillation. Which of the following interventions should be performed next?
   a. Establish vascular access and administer epinephrine 0.01 mg/kg.
   b. Defibrillate immediately with 2 J/kg.
   c. Perform synchronized cardioversion with 1 J/kg.
   d. Establish vascular access and administer amiodarone 5 mg/kg.

23. Which of the following statements is incorrect regarding pediatric defibrillation?
   a. Damp skin and air pockets beneath hand-held paddles or self-adhesive defibrillation pads increase transthoracic resistance and may cause an uneven delivery of current.
   b. Initial management of pulseless VT or VF includes CPR and delivery of three serial shocks in rapid succession without pausing to check for the presence of a pulse between each shock.
   c. Pediatric paddles or self-adhesive pads should be used when defibrillating patients up to 1 year of age however, adult paddles should be used when performing synchronized cardioversion.
   d. Alcohol-soaked pads should never be used during defibrillation.
24. Which of the following statements is correct regarding alternatives for failed or difficult pediatric tracheal intubation?
   a. Performing a needle cricothyrotomy is an acceptable alternative.
   b. Performing a surgical cricothyrotomy is generally contraindicated until age 18 years.
   c. Blind nasotracheal intubation is generally contraindicated until age 14 years.
   d. Insertion of an age-appropriate or size-appropriate laryngeal mask airway (LMA) is contraindicated.

25. Management of a tension pneumothorax in the pediatric patient may necessitate needle decompression of the chest. This is accomplished using an over-the-needle catheter inserted:
   a. In the fifth intercostal space in the midaxillary line, just above the sixth rib.
   b. In the fifth intercostal space in the midaxillary line, just below the sixth rib.
   c. In the second intercostal space in the midedclavicular line, just above the third rib.
   d. In the second intercostal space in the midedclavicular line, just below the third rib.

26. Select the incorrect statement regarding sinus tachycardia.
   a. Sinus tachycardia is a normal compensatory response to the need for increased cardiac output or oxygen delivery.
   b. In sinus tachycardia, the heart rate is usually more than 220 beats/minute in infants or 200 beats/minute in children.
   c. The onset of a sinus tachycardia occurs gradually.
   d. Patient management includes treatment of the underlying cause that precipitated the rhythm.

27. A 2-year-old boy appears to be choking. You find the child responsive, but cyanotic. He is unable to cough or speak. Initial interventions in this situation should include:
   a. Performing a blind finger sweep to remove the obstruction.
   b. Alternating 5 back blows with 5 chest thrusts.
   c. Performing direct laryngoscopy to visualize the obstruction.
   d. Informing the child that you are going to help him, and then performing abdominal thrusts.

28. Which of the following is NOT a desirable feature of a bag-valve-mask device?
   a. A clear mask
   b. A compressible, self-refilling bag
   c. Availability in adult and pediatric sizes
   d. Pop-off (pressure release) valve

29. A 3-year-old child weighing 15 kilograms requires tracheal intubation.
   a. What type of blade should be used?
   b. What size laryngoscope blade should be used?
   c. What size tracheal tube should be used?
   d. Should you use a cuffed or uncuffed tracheal tube for this child?
   e. When the tracheal tube has been inserted to the proper depth, what is the cm marking that should appear at the patient’s lips?
30. A 44-pound child presents with fever, irritability, mottled color, cool extremities, and a prolonged capillary refill time. The appropriate initial fluid bolus for administration to this child is:
   a. 100 mL of normal saline over 30 to 60 minutes.
   b. 200 mL of 5% dextrose in water in less than 20 minutes.
   c. 800 mL of normal saline or Ringer’s lactate infused over 30 to 60 minutes.
   d. 400 mL of normal saline or Ringer’s lactate in less than 20 minutes.

31. In the pediatric patient, cardiac arrest is most often due to:
   a. Myocardial trauma
   b. Respiratory failure
   c. Drug intoxication
   d. Severe electrolyte or acid-base imbalance

32. List the four essential questions to ask in the initial emergency management of a pediatric patient with a dysrhythmia.
   a.
   b.
   c.
   d.

Questions 33 through 35 pertain to the following scenario.

You are called to see an 18-month-old child with difficulty breathing. Mom reports the child has had a cough and cold for the past two days and appears worse today. You note the child is cyanotic and appears limp in his mother’s arms. His respiratory rate is rapid and shallow. Intercostal retractions are visible and wheezing is audible without a stethoscope.

33. From the information provided, complete the following documentation regarding the Pediatric Assessment Triangle.
   a. Appearance:
   b. Breathing:
   c. Circulation:

34. Your initial assessment reveals a patent airway. The child’s respiratory rate is 60/min. Auscultation of the chest reveals wheezes bilaterally. A weak brachial pulse is present at a rate of 194 beats/min. The skin is cyanotic. Capillary refill is 2 to 3 seconds; temperature is 101.8 F; and the pulse oximeter reveals a SpO2 of 80%. This child’s presentation is most consistent with:
   a. Respiratory distress
   b. Respiratory failure
   c. Respiratory arrest
   d. Cardiopulmonary arrest.

35. Is this child sick or not sick? Describe your approach to the initial management of this patient.
36. The child’s condition worsens. Central cyanosis persists despite administration of 100% oxygen. The child’s respiratory rate is now 8 to 14/min and shallow. The cardiac monitor reveals narrow QRS complexes at a rate of 32/min. You are unable to palpate a peripheral pulse, but a weak central pulse is present. An IV has been established. You should now:
   a. Begin chest compressions and give epinephrine.
   b. Give atropine.
   c. Continue to monitor the child closely for signs of deterioration.
   d. Give adenosine.

37. Select the **incorrect** statement.
   a. Hypotension is an early sign of shock in a child.
   b. The diastolic blood pressure is usually two-thirds of the systolic pressure.
   c. A child may be in shock despite a normal blood pressure.
   d. Blood pressure is one of the least sensitive indicators of adequate circulation in children.

38. The presence of compensated shock can be identified by:
   e. Assessment of heart rate, ECG rhythm, and skin temperature.
   f. Assessment of the presence and strength of peripheral pulses, mental status, and pupil response to light.
   g. Assessment of heart rate, presence and strength of peripheral pulses, and the adequacy of end-organ perfusion.
   h. Assessment of end-organ perfusion, ECG rhythm, and pupil response to light

Questions 39 through 45 refer to the following scenario.

A 3-year-old is found barely responsive by her babysitter. The babysitter was distracted “for just a minute” by a telephone call and lost track of the child. The child was located on the ground just outside the garage door. The patient’s skin looks flushed and she is laboring to breathe. You note secretions are draining from the patient’s mouth and she has been incontinent of urine. The child is unaware of your presence.

39. From the information provided, complete the following documentation regarding the Pediatric Assessment Triangle.
   a. Appearance:
   b. Breathing:
   c. Circulation:

40. Based on the information provided, your FIRST intervention should be to:
   a. Establish vascular access.
   b. Suction the airway.
   c. Perform a secondary (head-to-toes) survey.
   d. Perform tracheal intubation.

41. For each of the following, record the estimated values for a 3-year-old child.
   a. Weight:
   b. Respiratory rate:
   c. Heart rate:
   d. Blood pressure:
42. Your assessment reveals the child will open her eyes and withdraw in response to a painful stimulus but makes incomprehensible sounds. Her Glasgow Coma Scale score is:
   a. 6
   b. 8
   c. 10
   d. 12

43. The child’s respiratory rate is 44/min, heart rate is 158/min, and blood pressure is 80/60. Her skin is warm and moist. Her pupils are equal and reactive at 2 mm. Auscultation of her lungs reveals bilateral diffuse wheezes. Excessive oral secretions are present. These findings are most consistent with the __________________________ toxidrome.

44. Further questioning of the babysitter reveals that the child may have been out of sight for 20 to 30 minutes before she was found. The babysitter recalls having seen an open bottle of white liquid on the floor of the garage. As you continue interviewing the babysitter, a coworker tells you that he smells garlic on the child’s breath. This child was most likely exposed to:
   a. An organophosphate
   b. Camphor
   c. A narcotic
   d. A beta-blocker

45. You are instructed to administer atropine to this patient. Which of the following statements is correct?
   a. Question the order. Atropine is indicated for symptomatic bradycardia’s. This patient is not bradycardic.
   b. Administer the atropine as instructed. Atropine is being ordered in this situation to increase the patient’s blood pressure.
   c. Question the order. Although atropine may be used in situations such as this, the patient is tachycardic. Atropine is contraindicated if a tachycardia is present.
   d. Administer the atropine as instructed. In this situation, atropine is being given to dry the patient’s airway of secretions.

46. When administering medications by means of a tracheal tube you should:
   a. Continue chest compressions throughout administration of the medication.
   b. Insert a needle through the wall of the tracheal tube to administer the medication.
   c. Temporarily stop chest compressions, instill the medication down the tracheal tube, ventilate several times with a bag-valve device, then resume CPR.
   d. Temporarily stop chest compressions, instill the medication down the tracheal tube, ventilate the patient for a minimum of 5 minutes with a bag-valve device to ensure the drug is dispersed through the alveoli, and then resume CPR.

47. Medications used to maintain cardiac output include:
   a. Midazolam, epinephrine, and naloxone.
   b. Lorazepam, midazolam, and naloxone.
   c. Diazepam, dopamine, and dobutamine.
   d. Dopamine, epinephrine, and Dobutamine

48. The term “conscious sedation” is equivalent to:
49. Indications for the use of amiodarone include:
   a. Asystole
   b. Severe bradycardia
   c. Ventricular fibrillation
   d. Sinus tachycardia

50. The single most common cause of injury in children is:
   a. Motor vehicle crash
   b. Falls
   c. Pedestrian injuries
   d. Firearm-related injuries

**ASHI PALS by Mosby PRE-TEST**

**ANSWERS AND RATIONALES**

1. D. Pneumonia, asthma, and bronchiolitis are conditions that affect the lower airway. Croup, epiglottitis, and bacterial tracheitis are conditions that affect the upper airway.

2. D. Systemic complications of vascular access include sepsis, fluid overload/electrolyte imbalance, hypersensitivity reactions, air embolism, catheter-fragment embolism, and pulmonary thromboembolism. Local complications include pain and irritation, cellulitis, phlebitis, thrombosis, bleeding, hematoma formation, inadvertent arterial puncture, infiltration and extravasation, and nerve, tendon, ligament, and/or limb damage.

3. C. A child with signs of cyanosis, diminished breath sounds with minimal chest excursion, and an inadequate respiratory rate is exhibiting signs of respiratory failure. Signs of respiratory failure include the findings of respiratory distress with any of the following additions or modifications: sleepy, intermittently combative, or agitated; increased respiratory effort at sternal notch, absent or significantly decreased breath sounds, marked use of accessory muscles, retractions; head bobbing, grunting, gasping; central cyanosis despite oxygen administration; poor peripheral perfusion; mottling; marked tachycardia (bradycardia is a late sign), decreased muscle tone, decreased level of consciousness or response to pain; inadequate respiratory rate, effort, or chest excursion, or tachypnea with periods of bradypnea; slowing to bradypnea/agonal breathing.

4. C. In children, cardiopulmonary arrest is usually the result of respiratory failure or shock that progresses to cardiopulmonary failure with profound hypoxemia and acidosis, and eventually cardiopulmonary arrest.

5. C. Calcium administration is appropriate for documented or suspected hyperkalemia, ionized hypocalcemia, hypermagnesemia, or calcium channel blocker toxicity. If calcium chloride 10% is used, give 20 mg/kg (0.2 mL/kg) slowly IV/IO. If calcium gluconate 10% is used, give three times the dose of calcium chloride (i.e., 60 mg/kg [0.6 mL/kg]) slowly IV/IO.

6. A. Because epinephrine is supplied in different dilutions, it is important to ensure selection of the correct concentration before administering this medication. The tracheal dosage of
epinephrine for an infant or child is 0.1 mg/kg (0.1 mL/kg) of 1:1000 solution. This dose is 10 times the recommended initial IV/IO dose (0.01 mg/kg [0.1 mL/kg] of 1:10,000 solution).

7. A. Suctioning of the newly born infant should be limited to 3 to 5 seconds per attempt.
8. B. The peak incidence of sudden infant death syndrome is 2 to 4 months.
9. C. The infant has experienced an Apparent Life-Threatening Event (ALTE). These events can involve any of the following: apnea, color change (cyanosis, pallor, or erythema), marked change in muscle tone (limpness), choking or gagging. The infant should be transported and evaluated by a physician.
10. A. In 2002, more than 50% (51.6%) of human poisoning exposures occurred in children younger than 6 years; more than 30% occurred in children younger than 3 years. Death due to unintentional poisoning in young children is uncommon due to increased product safety measures (e.g., child-resistant packaging), increased poison prevention education, early recognition of exposure, and improvements in medical management. The majority of pediatric toxic exposures are unintentional, occur in the home, and involve only a single substance. Cosmetics and personal care products are the substances most frequently involved in pediatric exposures involving children < 6 years.
11. D. Positive-pressure ventilation should be provided at an age-appropriate rate, allowing 1 to 1 ½ seconds per ventilation. Provide ventilations for infants and children at a rate of 20 breaths/minute (1 breath every 3 seconds). Ventilate an adolescent at a rate of 12 breaths/minute (1 breath every 5 seconds).
12. A. The rhythm shown is a sinus bradycardia.
13. C. Despite the presence of an organized rhythm on the monitor that you would expect to produce a pulse, the child is pulseless. This situation is called pulseless electrical activity (PEA). Many conditions may cause PEA. PEA has a poor prognosis unless the underlying cause can be rapidly identified and appropriately managed.
14. Possible reversible causes of PEA include hypoxemia (give oxygen), hypovolemia (replace volume), hypothermia (use simple warming techniques), hyper-/hypokalemia and metabolic disorders (correct electrolyte and acid-base disturbances), cardiac tamponade (pericardiocentesis), tension pneumothorax (needle decompression), toxins/poisons/drugs (give antidote/specific therapy), and thromboembolism.
15. B. The most common thoracic injuries seen in children are pulmonary contusion/laceration (53%), pneumothorax/hemothorax (38%), rib/sternal fractures (36%), cardiac (5%), diaphragm (2%), major blood vessel (1%). In children, thoracic trauma is associated with a high mortality rate. The greater elasticity and resilience of the chest wall in children makes rib and sternum fractures less common than in adults however, force is more easily transmitted to the underlying lung tissues, resulting in pulmonary contusion, pneumothorax, or hemothorax. A pulmonary contusion is a potentially life-threatening injury that is frequently missed due to the presence of other associated injuries.
16. C. Epinephrine is a first-line medication used in the management of PEA.
17. B. Epinephrine stimulates alpha, beta-1, and beta-2 receptors. Effects of alpha receptor stimulation results in constriction of the arterioles in the skin, mucosa, kidneys, and viscera ? increased systemic vascular resistance. These effects are beneficial in cardiac arrest because blood is shunted to the heart and brain. Effects of beta-1 receptor stimulation include increased force of contraction (+ inotropic effect) and increased heart rate (+ chronotropic effect). These effects result in increased myocardial workload and oxygen requirements. Stimulation of beta-2 receptors results in relaxation of bronchial smooth muscle.
18. No. Although the patient has no pulse, organized electrical activity is visible on the cardiac monitor. Defibrillation is used to terminate disorganized cardiac rhythms, such as
ventricular fibrillation. The shock attempts to deliver a uniform electrical current of sufficient intensity to simultaneously depolarize ventricular cells, including fibrillating cells, causing momentary asystole. This provides an opportunity for the heart's natural pacemakers to resume normal activity.

19. C. The Glasgow Coma Scale is used to assess a patient’s level of responsiveness by evaluating best verbal response, best motor response, and eye opening. The minimum possible score is 3, maximum possible score 15. When caring for an infant or child, use the GCS that has been modified for pediatric use.

20. Absent/pulseless rhythms include 1) pulseless ventricular tachycardia, in which the ECG displays a wide QRS complex at a rate faster than 120 beats/min, 2) ventricular fibrillation, in which irregular chaotic deflections that vary in shape and amplitude are observed on the ECG but there is no coordinated ventricular contraction, 3) asystole, in which no cardiac electrical activity is present, and 4) pulseless electrical activity (PEA), in which electrical activity is visible on the ECG but central pulses are absent.

21. Tracheal tube size may be estimated using the following formula for children more than 2 years of age: 16 + age in years/4. Some systems use the formula 4 + age in years/4.

22. B. The definitive treatment for ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT) is defibrillation. When pulseless VT or VF is present, defibrillation takes priority over attempts to establish vascular access or administration of medications. Synchronized cardioversion is not indicated for VF.

23. C. The same size paddle or self-adhesive pad should be used for both defibrillation and cardioversion. The largest size paddle that allows good skin contact but maintains separation between the two paddles is preferred. Infant paddles should be used for patients up to 1 year of age or 10 kg. Larger paddles may be used as long as contact between the paddles is avoided. Adult paddles should be used for patients older than 1 year or weighing more than 10 kg. Damp skin and air pockets beneath hand-held paddles or self-adhesive defibrillation pads increase transthoracic resistance and may cause an uneven delivery of current. Initial management of pulseless VT or VF includes CPR and delivery of shocks pausing to check for the presence of a pulse between each shock (assuming the rhythm is unchanged). Do not use alcohol-soaked pads for defibrillation – they may ignite!

24. A. Alternatives for failed or difficult pediatric tracheal intubation include:
   a. Combitube: only if over 4 feet tall
   b. Laryngeal mask airway (LMA) for age: acceptable
   c. Blind nasotracheal intubation: contraindicated until age 10 years
   d. Needle cricothyrotomy: acceptable
   e. Surgical cricothyrotomy: contraindicated until age 10 years

25. C. Management of a tension pneumothorax in the pediatric patient may necessitate needle decompression of the chest. This is accomplished using an over-the-needle catheter inserted in the second intercostal space in the midclavicular line, just above the third rib.

26. B. Sinus tachycardia is a normal compensatory response to the need for increased cardiac output or oxygen delivery. In sinus tachycardia, the heart rate is usually less than 220 beats per minute in infants or 180 beats per minute in children. Onset of the rhythm occurs gradually. The ECG shows a regular, narrow QRS complex rhythm that often varies in response to activity or stimulation. P waves are present before each QRS complex. The history given typically explains the rapid heart rate (i.e., pain, fever, volume loss due to trauma, vomiting, or diarrhea). Patient management includes treatment of the underlying cause that precipitated the rhythm (e.g., administering medications to relieve pain, administration of fluids to correct hypovolemia due to diarrhea).

27. D. Inform the child that you are going to help him, then administer abdominal thrusts until the object is expelled or the child becomes unresponsive. A blind finger sweep should not
be performed in an infant or child, and is never appropriate in a responsive choking victim. A blind finger sweep may push the foreign body into the airway, causing further obstruction. Back blows and chest thrusts are appropriate maneuvers to relieve foreign body airway obstruction in infants, not children. Although direct laryngoscopy may ultimately be necessary, it is not performed before attempting less invasive methods of relieving the obstruction.

28. D. The BVM used for resuscitation should have either no pop-off (pressure-release) valve or a pop-off valve that can be disabled during resuscitation. Some resuscitation situations require higher than normal ventilatory pressure, such as near-drowning, CPR, pulmonary edema, asthma, partial upper airway obstruction, or initial resuscitation of the newly born. To effectively ventilate a patient in these situations, the ventilatory pressure needed may exceed the limits of the pop-off valve. Thus, a pop-off valve may prevent generation of sufficient tidal volume to overcome the increase in airway resistance.

29. Tracheal intubation of a 3-year-old, 15 kg child:
   a. A straight or curved blade may be used.
   b. A size 2 laryngoscope blade should be used.
   c. A 5.0 mm tracheal tube should be used. Be sure to have a 4.5 mm and 5.5 mm immediately available.
   d. Use an uncuffed tracheal tube for this child.
   e. When the tracheal tube has been inserted to the proper depth, the 14 to 15 cm marking should appear at the patient’s lips

30. D. Administer a bolus of 20 mL/kg of isotonic crystalloid solution (NS or LR) over 5 to 20 minutes. 44 pounds = 20 kilograms. For this child, the appropriate initial fluid bolus is 400 mL of normal saline or Ringer’s lactate.

31. B. In children, cardiopulmonary arrest is usually the result of respiratory failure or shock that progresses to cardiopulmonary failure with profound hypoxemia and acidosis, and eventually cardiopulmonary arrest.

32. The initial emergency management of pediatric dysrhythmias requires a response to four important questions:
   a. Is a pulse (and other signs of circulation) present?
   b. Is the rate within normal limits for age, too fast, too slow, or absent?
   c. Is the QRS wide (ventricular in origin) or narrow (supraventricular in origin)?
   d. Is the patient sick (unstable) or not sick (stable)?

33. Pediatric Assessment Triangle (first impression) findings:
   a. Appearance: Awake but appears limp
   b. Breathing: Respirations are rapid and shallow; audible wheezing is present; increased work of breathing evident
   c. Circulation: Skin is cyanotic; no evidence of bleeding

34. B. This child’s presentation is most consistent with respiratory failure. The presence of tachypnea and tachycardia reflects compensatory mechanisms that are attempting to increase cardiac output. However, these mechanisms will fail (signifying the onset of cardiopulmonary failure) as oxygen demand increases and the child tires. Aggressive treatment is essential.

35. This child is sick. Move quickly. Open the airway and suction if necessary. Correct hypoxia by giving high-flow oxygen. Begin assisted ventilation if the patient does not improve. Provide further interventions based on assessment findings.

36. A. If there is no improvement after approximately 30 seconds of effective assisted ventilation and the child’s heart rate is less than 60 beats/min with signs of poor perfusion, begin chest compressions and give epinephrine. If the bradycardia persists, consider
atropine and pacing. Adenosine is contraindicated in this situation because the patient is bradycardic. Adenosine is used to slow the heart rate in supraventricular tachycardia (SVT).

37. A. Hypotension is a late sign of shock in a child. Tachycardia and signs of poor perfusion such as pale, cool, mottled skin occur earlier and are more reliable indicators than hypotension.

38. C. The presence of compensated shock can be identified by evaluation of heart rate, the presence and volume (strength) of peripheral pulses, and the adequacy of end-organ perfusion (Brain – assess mental status, skin – assess capillary refill, skin temperature, and kidneys – assess urine output).

39. Pediatric Assessment Triangle (first impression) findings:
   a. Appearance: barely responsive, incontinent of urine, unaware of your presence
   b. Breathing: increased work of breathing evident
   c. Circulation: Skin is flushed; no evidence of bleeding

40. B. The presence of secretions draining from the mouth of a child that is unaware of your presence requires immediate intervention. Clear the airway with suctioning.

41. “Normal” values for a 3-year-old child:
   a. Weight: 14 kg (31 lb.)
   b. Respiratory rate: 24 to 40
   c. Heart rate: 90 to 150
   d. Blood pressure: BP > 70
   Refer to the tables and formulas in Chapter 3 if you need to review this information.

42. B. The patient’s Glasgow Coma Scale score is 8.

   Eyes: To pain 2
   Verbal: Incomprehensible sounds 2
   Motor: Withdraws from pain 4

43. This patient’s physical findings are most consistent with the cholinergic toxidrome.

44. A. The patient’s physical findings and additional information regarding the events surrounding the exposure strongly suggest organophosphate exposure.

45. D. Atropine is the antidote for the muscarinic effects of organophosphate exposure. The goal of atropine administration in this situation is drying of airway secretions to maintain oxygenation and ventilation. Tachycardia is NOT a contraindication to its use.

46. C. When administering medications by means of a tracheal tube, temporarily stop chest compressions, instill the medication down the tube, ventilate several times with a bag-valve device, then resume CPR.

47. D. Dopamine, epinephrine, and dobutamine are medications used to maintain cardiac output. Midazolam (Versed), lorazepam (Ativan), and diazepam (Valium) are benzodiazepines used for sedation. Naloxone (Narcan) is an opioid (narcotic) antagonist.

48. B. Sedation is dose-dependent continuum from minimal sedation to general anesthesia. Individual patient responses to a given dosage of a drug vary. Because of this variation in patient response, the American Society of Anesthesiologists (ASA) prefers the term “sedation-analgesia” and the American College of Emergency Physicians (ACEP) uses the term “procedural sedation” instead of “conscious sedation.”

49. C. Amiodarone may be used in the treatment of pulseless VT/VF and perfusing tachycardias – particularly ectopic atrial tachycardia, junctional ectopic tachycardia, and ventricular tachycardia.

50. B. Falls are the single most common cause of injury in children.
2010 Guidelines PALS Provider Course Objectives and Schedule

**Course Objectives:**
Upon successful completion of the course, the participant will be able to:
* Recognize an infant or child at risk for cardiopulmonary arrest resulting from shock or respiratory failure, and take effective steps to reverse or prevent the arrest.
* Perform effective basic life support and bag-valve-mask ventilation on the infant and child.
* Demonstrate the types, uses, and indications of airway adjuncts and equipment needed in resuscitation.
* Recognize life-threatening rhythm disturbances in children and discuss their treatment.
* Discuss peripheral and intraosseous cannulation in infants and children.
* Perform as a team member and leader during simulated resuscitation of an infant and child.

**Weekdays: SES 1: discussion, SES 2: Skills stations**
3:00-6:00 PM Registration: Participants turn in copy of current BLS/CPR card. Get acquainted. Food and Beverages.
6:00-6:15 Welcome: Introduction; What's new, Overview of Tonight's Topic's Perfusion for Compensation.
6:15-7:00 Whole group demonstrations/discussions on cases, Shock (IV/IO), Newborn Resuscitation, respiratory failure, cardiopulmonary arrest, Medications
7:00-8:00 Managing the Code-Putting it all together
8:00-9:45 Practice and learning stations-Respiratory Failure, Shock, Rhythm Disturbances, Unknown
9:45-10:00 Overview and adjournment

**Weekends: SAME**
8:30-9:00 AM Instructor meeting: Turn in BLS Cards (still Due) What's new! Q & A
9:00-9:30 Whole group demonstrations/discussions. Putting it all together-. Compensation for Perfusion
9:30-12:00 Team Teaching/Evaluation Stations-Respiratory Failure, Shock, Rhythm Disturbances, Unknown
12:00-12:30 LUNCH - Optional, can take written Here.
12:30-5:15 Team Teaching/Evaluation Stations-Respiratory Failure, Shock, Rhythm Disturbances, Unknown /Remediation
Shock (IV/IO), Newborn Resuscitation, respiratory failure, cardiopulmonary arrest, Medications
5:45-6:15 Overview and Discussion
6:15-6:30 Student and Instructor Debriefing
** each station approx. 45 minutes in duration.
# ASHI PALS™ Student Course Evaluation Form

Please rate the following ASHI PALS program elements.  
(\(\sqrt{5} = \text{excellent}\)  

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## Course Materials

- ASHI PALS Student Course textbook –
- Audiovisual materials

## Physical Facilities

- Space for lectures and skills stations
- Equipment

## Behavioral Outcomes

- Instructors achieved stated objectives
- You achieved stated objectives
- Your overall score for the course

Thank you for allowing us the opportunity to be a part of your continuing education. We welcome your comments and suggestions and will use them to improve our programs. Please add additional comments here and continue on the back of this form if necessary.
INDIVIDUAL OFFERING APPROVAL FORM
CONTINUING NURSING EDUCATION

PLEASE PRINT OR TYP

PART 1
NAME_______________________________________  KS LICENSE # ____________________
ADDRESS__________________________________       TELEPHONE # ____________________
CITY_______________________________________ STATE________________ ZIP CODE________

OFFERING TITLE________________________________________________________________________

OFFERING LOCATION     _________ OFFERING DATE                       __

PROVIDER                  _______________ PROVIDER'S ADDRESS                 _____________

PART 2
RATIONALE STATEMENT: Brief explanation of how this relates to your nursing practice:

SIGNATURE __________________________________________________________________

PART 3
ATTACHMENTS: (Note: All must be attached or the form will be returned)
A. Learning/ Behavior Objectives
B. Offering Agenda/Schedule with times listed to verify the length of the offering
C. Certificate of Attendance if offering completed
D. Self Addressed, Stamped Envelope

PART 4                                     FOR OFFICE USE ONLY

Approved_____ NOT APPROVED_____ IF APPROVED, NUMBER OF CONTACT HOURS_______

_____If checked, you must attach a copy of your certificate of completion/attendance with
this form and keep with your continuing education records to be submitted if you are selected for an audit.

Patty L. Brown, BSN, MS            Education Specialist                 Date

This form serves as your continuing education certificate. On your renewal form under “provider” list IOA and LT0108-0338 as the provider number.
YOU **DO NOT** NEED TO COMPLETE THIS FORM **IF ANY** of the following apply:

1. your certificate of completion/attendance indicates a KSBN provider number beginning with LT or SP
2. You took a course in a nursing degree program, or a prerequisite for admission to a nursing degree program
3. your certificate of completion/attendance indicates the offering has been approved for continuing nursing education by a state board of nursing or a national nursing organization.

CONTINUING NURSING EDUCATION CREDIT **cannot** be given for:

1. In-service programs
2. on-the-job training
3. orientation for a job
4. CPR, BCLS, or Code Blue
5. testing out of a course

**INDIVIDUAL OFFERING APPROVAL FORM INSTRUCTIONS**

Individuals requesting CNE hours for offerings not approved for nursing continuing education by the Kansas State Board of Nursing should complete and submit this application PRIOR TO LICENSE RENEWAL.

Part 1. Complete the information required in Part 1 of the form

Part 2. Nursing continuing education is defined as “learning experiences intended to build upon the educational and experiential bases of the nurse for enhancement of practice, education, administration, research or theory development to the end of improving the health of the public”. The rationale should be a brief explanation of why this offering is relevant continuing nursing education for you.

Part 3. Attachments:
   a. Learning/behavior objectives: These objectives will be statements about what you learned (or anticipate learning) in this offering and how the information will help in your practice as a nurse. You may use the learning objectives provided in the offering but restate them in nursing terms.
   b. agenda or time schedule to verify the length of the offering
   c. certificate of attendance
   d. Enclose a self-addressed stamped envelope

Send to: **Kansas State Board of Nursing, Landon State Office Building, 900 SW Jackson, Room 1051, Topeka KS 66612-1230**

Fax: (785) 296-3929

Allow at least 2 weeks processing time from the date this form is received in the KSBN office. If you have questions concerning this form, please call the KSBN Education Dept (785-296-3782)

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