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## BLS Study Guide

ACLS - BLS - CPR - PALS - ECG

## Course Overview

This study guide is an outline of content that will be taught in the American Heart Association Accredited Basic Life Support (BLS) Course. It is intended to summarize important content, but since all BLS content cannot possibly be absorbed in a class given every two years, it is expected that the student will have the 2015 Updated ECC Handbook readily available for review as a reference. The student is also required to have the AHA BLS Textbook available for reference and study for more in depth content.

### **Evidence Based Updates**

Approximately every 5 years the AHA updates the guidelines for CPR and Emergency Cardiovascular Care. These updates are necessary to ensure that all AHA courses contain the best information and recommendations that can be supported by current scientific evidence experts from outside the United States and outside the AHA. The guidelines were then classified as to the strength of evidence that supports the recommendation.

### ***Critical Concepts***

High-quality CPR improves a victim's chances of survival. The critical characteristics of high-quality CPR include.

- Start compressions within 10 seconds
- Compression rate of 100-120/min
- Compress to a depth of at least 2 inches
- Allow complete chest recoil
- Minimize interruptions
- Give effective breaths
- Avoid excessive ventilations

### 2015 AHA Guidelines for CPR and ECC Science Update

The 2015 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care recommendations for healthcare providers include the following key changes and issues:

- Changes in basic life support (BLS sequence)
- Continued emphasis on high-quality CPR, with minor changes in compression rate and depth
- Additional changes regarding cricoid pressure, pulse check and AED use in infants



## Changes in Sequence:

### C-A-B – NOT – A-B-C

In the A-B-C sequence, chest compressions were often delayed while the rescuer opened the airway to give mouth-to-mouth breaths, retrieved a barrier device, or gathered and assembled ventilation equipment. By changing the sequence to C-A-B, rescuers can start chest compressions sooner, and the delay in giving breaths should be minimal (only the time required to deliver the first cycle of 30 chest compressions, or approximately 18 seconds or less; for 2-rescuer infant or child CPR, the delay will be even shorter).

### Emphasis on High-Quality CPR

- A compression rate of 100-120/min (this is a change from “approximately 100/min)
- A compression depth of at least 2 inches (5cm), but not greater than 2.4 inches (6 cm) in adult and a compression depth of at least one third of the anterior-posterior diameter of the chest in infants and children. This is approximately 1 ½ inches (4cm) in infants and 2 inches (5cm) in children. Note that the range of 1 ½ to 2 inches is no longer used for adults, and the absolute depth specified for children and infants is deeper than in previous versions of the AHA Guidelines for CPR and ECC.
- Allow complete chest recoil, minimizing interruptions in compressions, and avoiding excessive ventilation continues to be important components of high-quality CPR.

*The Routine use of cricoid pressure in cardiac arrest is not recommended*

- *It may block ventilation*
- *Delay the placement of an advance airway*
- *Difficult to train rescuers how to do this*

### *Use of an AED for infants*

- For infants, a manual defibrillator is preferred to an AED for defibrillation.
- If a manual defibrillator is not available, an AED equipped with a pediatric dose attenuator is preferred
- If neither is available, you may use an AED without a pediatric dose attenuator

### Continued de-emphasis of the pulse check

- It can be difficult to determine the presence or absence of pulse within 10 seconds, especially in an emergency, and studies show that both healthcare providers and lay rescuers are unable to reliably detect a pulse
  - If a victim is unresponsive and not breathing or only gasping, healthcare providers may take up to 10 seconds to attempt to feel for a pulse (brachial in an infant and carotid or femoral in a child)
  - If within 10 seconds you don't feel a pulse or are not sure if you feel a pulse, begin chest compressions.



## BLS/CPR for Adults

### BLS Consist of these main parts

- Chest Compressions
- Airway
- Breathing
- Defibrillation

### Follow these initial BLS steps for adults

1. Assess the victim for a response and look for normal or abnormal breathing. If there is no response and not breathing or no normal breathing (i.e., only gasping), shout for help.
2. If you are alone, activate the emergency response system and get an AED (or defibrillator) if available and return to the victim.
3. *Check the victim's pulse (take at least 5 but no more than 10 seconds)*
4. *If you do not definitely feel a pulse within 10 seconds, perform 5 cycles of compressions and breaths (30:2), starting with compressions (C-A-B sequence)*

### Step 1: Assessment and Scene Safety

- The first rescuer who arrives at the side of the victim must quickly be sure that the scene is safe.
- The rescuer should then check the victim for a response.
  - Shout, "Are you all right?"
- If a victim is not breathing or not breathing normally (i.e., gasping), you must activate the emergency response system.

## IF IN THE HOSPITAL, CALL THE CODE!!

### Step 2: Activate the Emergency Response System and Get an AED

- If you are alone and find an unresponsive victim not breathing, shout for help
- If no response activate the emergency response system using a mobile device if appropriate, get an AED
- *Return to the victim to check a pulse and begin CPR (C-A-B sequence).*

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### Importance of a Firm Surface

*Compressions pump the blood in the heart to the rest of the body. If a firm surface is under the victim, the force you use will be more likely to compress the chest and heart and create blood flow rather than simply push the victim into the mattress or other soft surface.*

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### Step 3: Pulse Check

- *Healthcare providers should take no more than 10 seconds to check for pulse. To minimize delay, you may assess breathing at the same time as you check the pulse. Palpate the carotid pulse.*

### Step 4: CPR

- *Begin cycles of 30 chest compression and 2 breaths (CPR)*
- Lone rescuer should use the compression-ventilation ratio of 30 compressions to 2 breaths when giving CPR to victims of any age.
- *Put the heel of one hand on the center of the victim's chest on the lower half of the breastbone.*



## Moving the Victim

- Do not move the victim while CPR is in progress unless the victim is in dangerous environment (such as a burning building) or if you believe you cannot perform CPR effectively in the victim's present position or location.

## Opening the Airway for Breaths: Head Tilt-Chin Lift

1. Place one hand on the victim's forehead and push with your palm to tilt the head back
2. Place the fingers of the other hand under the bony part of the lower jaw near the chin
3. Lift the jaw to bring the chin forward

## Giving Mouth – to – Mask Breaths

1. Position yourself at the victim's side
2. Place the mask on the victim's face, using the bridge of the nose as a guide for correct position.
3. Seal the mask against the face:
  - a. Using the hand that is closer to the top of the victim's head, place your index finger and thumb along the edge of the mask.
  - b. Place the thumb of your second hand along the bottom edge of the mask
4. Place the remaining fingers of your second hand along the bony margin of the jaw and lift the jaw. Perform a head tilt-chin lift to open the airway
5. While you lift the jaw, press firmly and completely around the outside edge of the mask to seal the mask against the face.
6. Deliver air over 1 second to make the victim's chest rise.

## Using the Bag-Mask During 2-Rescuer CPR

1. Position yourself directly above the victim's head
2. Place the mask on the victim's face, using the bridge of the nose as a guide for correct position
3. Use the E – C clamp technique to hold the mask in place while you lift the jaw to hold the airway open
  - a. Perform a head tilt
  - b. Place the mask on the face with the narrow portion of the bridge of the nose
  - c. Use the thumb and index finger of one hand to make a "C" on the side of the mask, pressing the edges of the mask to the face.
  - d. Using the remaining fingers to lift the angles of the jaw (3 fingers form an "E") open the airway and press the face to the mask
4. Squeeze the bag to give breaths (1 second each) while watching for chest rise. Deliver all breaths over 1 second whether or not you use supplemental oxygen.

*The bag-mask ventilation technique requires instruction and practice and is not recommended by a lone rescuer during CPR*



| Rescuer          | Location             | Duties   |
|------------------|----------------------|--|
| <b>Rescuer 1</b> | At the victim's side | <ul style="list-style-type: none"> <li>• Perform chest compressions. <ul style="list-style-type: none"> <li>• Compress the chest at least 2 inches (5cm)</li> <li>• Compress at a rate of 100-120/min</li> <li>• Allow the chest to recoil completely after each compression.</li> <li>• Minimize interruptions in compressions (try to limit any interruptions in chest compression to &lt;10 seconds)</li> <li>• Count Compressions aloud</li> </ul> </li> <li>• <i>Switch duties with the second rescuer every 5 cycles or about 2 minutes, taking &lt;5 seconds to switch</i></li> </ul> |
| <b>Rescuer 2</b> | At the victim's side | <ul style="list-style-type: none"> <li>• <i>Maintain an open airway using either</i> <ul style="list-style-type: none"> <li>• <i>Head tilt-chin lift</i></li> <li>• <i>Jaw thrust</i></li> </ul> </li> <li>• <i>Giving breaths, watching the chest rise and avoiding excessive ventilation</i></li> <li>• Encourage the first rescuer to perform compressions that are deep enough and fast enough and to allow complete chest recoil between compressions.</li> <li>• Switch duties with the first rescuer every 5 cycles or about 2 minutes, taking &lt;5 seconds to switch</li> </ul>     |

*Analysis of thousands of rhythm strips recorded before and after shock delivery has shown that if rescuer can keep the time between the last compression and shock delivery to 10 seconds or less, the shock is much more likely to be effective (i.e. To eliminate ventricular fibrillation and result in return of spontaneous circulation)*

*To avoid gastric inflation DO NOT GIVE breathes too quickly or with much force.*



## Automated External Defibrillator

| Steps | Actions   |
|-------|---|
| 1     | <b>POWER ON the AED</b> (the AED will then guide you through the next steps) <ul style="list-style-type: none"> <li>Open the carrying case or the top of the AED</li> <li>Turn the power on (some devices will “power on” automatically when you open the lid or case)</li> </ul>   |
| 2     | <b>ATTACH</b> AED pads to the victim’s bare chest. (See Special Considerations below) <ul style="list-style-type: none"> <li>Choose adult pads (not child pads or a child system) for victim’s 8 years of age and older</li> <li>Peel the backing away from the AED pads</li> <li>Attach the adhesive AED pads to the victim’s bare chest. <ul style="list-style-type: none"> <li>Place one AED pad on the victim’s upper-right chest (directly below the collarbone)</li> <li>Place the other pad to the side of the left nipple, with the top edge of the pad a few inches below the armpit</li> </ul> </li> <li>Attach the AED connecting cables to the AED box (some are preconnected)</li> </ul> |
| 3     | “Clear” the victim and <b>ANALYZE</b> the rhythm <ul style="list-style-type: none"> <li>If the AED prompts you, clear the victim during analysis. Be sure no one is touching the victim, not even the rescuer in charge of giving breaths.</li> <li>Some AEDs will tell you to push a button to allow the AED to begin analyzing the heart rhythm; others will do that automatically. The AED may take about 5 to 15 seconds to analyze.</li> <li>The AED then tells you if a shock is needed.</li> </ul>   |
| 4     | <b>If the AED advises to shock, it will tell you to clear the victim</b> <ul style="list-style-type: none"> <li>Clear the victim before delivering the shock: be sure no one is touching the victim</li> <li>Loudly state a “clear the victim” message, much as “Everybody clear” or simply “Clear”</li> <li>Look to be sure no one is in contact with the victim.</li> <li>Press the SHOCK button</li> <li>The shock will produce a sudden contraction of the victim’s muscles</li> </ul>  |
| 5     | If no shock is needed, and after any shock delivery, <b>immediately resume CPR</b> , start with chest compressions  |
| 6     | After 5 cycles or about 2 minutes of CPR, the AED will prompt you to repeat steps 3 and 4.  |
|       | If “no shock advised”, immediately restart CPR beginning with chest compressions.   |

### *Special Considerations for using an AED*

*Never use an AED in a wet environment. Water is a good conductor of electricity. Pull the victim out of the water and dry the chest before attaching pads.*

*AED pads may not stick to a hairy chest. Use the included razor to shave the area for pad placement, or use one set of pads to remove the hair*

*Do not place the pads over an implanted device (AICD or pacemaker) or a medication*





If your AED includes a smaller size pad designed for children, use it. **IF NOT, USE THE STANDARD PADS, MAKING SURE THEY DO NOT TOUCH OR OVERLAP**

## BLS/CPR for Children From 1 Year of Age to Puberty

### Child BLS

The child BLS sequence and skills are similar to the sequence for adult BLS. The key differences between child and adult BLS are:

- **Compression-ventilation ratio for 2-rescuer CPR:** Use the same as for an adult with a rate of 100-120/min
- **Compression depth:** For children, compress at least one third the anteroposterior diameter of the chest in pediatric patients (infants [younger than one year] to children up to the onset of puberty). This equates to approximately 1.5 inches (4 cm) in infants to 2 inches (5 cm) in children. Once children have reached puberty (i.e. adolescents), the recommended adult compression depth of at least 2 inches (5cm), but no greater than 2.4 inches (6 cm) is used
- **Compression technique:** May use 1 – or 2 – handed chest compressions for very small children
- **When to activate the emergency response system:**
  - If you did not witness the arrest and are alone, provide 2 minutes of CPR before leaving the child to activate the emergency response system and get the AED (or defibrillator)
  - If the arrest is sudden and witnessed, leave the child to activate the emergency response system and get the AED (or defibrillator), and then return of the child.

### Compression Rate and Ratio for Lone Rescuer

The lone rescuer should use the universal compression-ventilation ratio of *30 compressions to 2 breaths* when giving CPR to victims of all ages (except newly born infants). The term universal represents a consistent recommended ratio for all lone rescuers for victims of all ages. For out-of-hospital cardiac arrest, emphasis is on chest compressions even if the provider is not trained.

**2 – Rescuer Child BLS Sequence** – Follow these steps to perform the 2 – rescuer BLS sequence for a child (no AED)

| Steps | Action   |
|-------|--|
| 1     | Check the child for a response and check breathing. If there is no response and no breathing or only gasping, the second rescuer activates the emergency response system |

## Critical Concepts

High-Quality CPR improves the victim's change of survival. The critical characteristics of high-quality CPR in adults includes:

- Start compressions within 10 seconds
- Push to a depth of at least 2 inches, but not greater than 2.4 inches. Use a rate of 100-120/min
- Allow complete chest recoil
- Minimize interruptions
- Give effective breaths
- Avoid excessive ventilations





|   |   |
|---|---|
| 2 | Check the child's pulse (take at least 5 but no more than 10 seconds). You may try to feel the child's carotid or femoral pulse.  |
| 3 | If within 10 seconds you don't definitely feel a pulse or if, despite adequate oxygenation and ventilation, the heart rate is <60/min with signs of poor perfusion, perform cycles of compressions and breaths (30:2 ratio). <i>When the second rescuer arrives, use compressions – to – breaths ratio of 15:2.</i> |

### BLS / CPR for Infants

For the purposes of the BLS sequence described in the Pediatric BLS Algorithm, the term infant means infants to 1 years of age (12 months), excluding newly born infants in the delivery room. For BLS for children 1 years and older, see “BLS/CPR for Children 1 Year of Age to Puberty”

The infant BLS sequence and skills are very similar to those used for child and adult CPR. They key differences for infant BLS are:

- **The location of pulse check:** *brachial artery in infants*
- **Technique of delivering compressions:** 2 fingers for single rescuer and 2 thumb – encircling hands technique for 2 rescuers
- **Compression depth:** at least one third and chest depth, *approximately 1 ½ inches (4cm)*
- **Compression-ventilation rate & ratio for 2 rescuers:** same as for child – 15:2 ratio for 2 rescuers
- **When to active the emergency response system (same as for child):**
  - If you did not witness the arrest and are alone, provide 2 minutes of CPR before leaving the infant to active the emergency response system and get the AED (or defibrillator).
  - If the arrest is sudden and witnessed, leave the infant to phone 911 and get the AED (or defibrillator), then return to the infant.

## 2 – Finger Chest Compression Technique

Follow these steps to give chest compressions to an infant using the 2-finger technique.

| Steps | Actions   |
|-------|---|
| 1     | Place the infant on a firm, flat surface  |
| 2     | Place 2 fingers in the center of the infant's chest just below the nipple line. Do not press on the bottom of the breastbone  |
| 3     | Push hard and fast. To give chest compressions, press the infant's breastbone down <i>at least one-third the depth of the chest (approximately 1 ½ inches (4cm))</i> . Deliver compressions in a smooth fashion at a rate of 100-120/min  |
| 4     | At the end of each compression, make sure you allow the chest to recoil (re-expand) completely. Chest recoil allows blood to flow into the heart and is necessary to create blood flow during chest compressions. Incomplete chest recoil will reduce the blood flow created by chest compressions. Chest compressions and chest recoil/relaxation times should be approximately equal. |
| 5     | Minimize interruptions in chest compressions.   |



## 2 Thumb – Encircling Hands Chest Compression Technique

Follow these steps to give chest compressions to an infant using the 2 thumbs – encircling hand technique.

1. Place both thumbs side by side in the center of the infant's chest on the lower half of the breastbone. The thumbs may overlap in very small infants.
2. Encircle the infant's chest and support the infant's back with the fingers of both hands.
3. With your hands encircling the chest, use both thumbs to depress the breastbone approximately one third of the depth of the infant's chest (approximately 1 ½ inches {4cm})
4. Deliver compressions in a smooth fashion at a rate of at least 100/min
5. After compressions, completely release the pressure on the breastbone and allow the chest to recoil completely
6. After every 15 compressions, pause briefly for the second rescuer to open the airway with the head tilt-chin lift and given 2 breaths. The chest should rise with each breath.
7. Continue compressions and breaths in a ratio of 15:2 (for 2 rescuers), switching roles every 2 minutes to avoid rescuer fatigue.

The 2 thumb-encircling hand techniques is the preferred 2-rescuer-chest compression technique for healthcare providers who can fit their hands around the infant's chest.

### CPR with an Advanced Airway

| Ventilation Technique  | Compressions to Breaths (Adult)   | Compressions to Breaths (Child and Infant)  |
|--|---|---|
| <b>No Advanced Airway</b><br>(mouth-to-mouth, mouth-to-mask, bag-mask)                   | <ul style="list-style-type: none"><li>• 30 compressions to 2 breaths</li><li>• Compression rate of 100-120/min</li></ul>  | <ul style="list-style-type: none"><li>• 15 compressions to 2 breaths (2 rescuers)</li><li>• 30 compressions to 2 breaths (1 rescuer)</li><li>• Compression rate 100-120/min</li></ul> |
| <b>Advanced airway</b><br>(endotracheal intubation, laryngeal mask airway, supraglottic) | <ul style="list-style-type: none"><li>• <i>Compression rate of 100-120/min without pauses for breaths</i></li><li>• <i>Continuous compressions without pauses for breaths</i></li><li>• <i>1 breath every 6 (8 to 10 breaths per minute) for adults, children and infants</i></li></ul> |   |



*In infants and children, if, despite adequate oxygenation and ventilation, the pulse is <60/min with signs of poor perfusion, START CPR*

## Adult, Child, and Infant Rescue Breathing

### Rescue Breathing

When an adult, child, or infant has a pulse but is not breathing effectively, rescuers should give breaths without chest compression. This is rescue breathing.

| Rescue Breathing for Adults  | Rescue Breathing for Infants and Children   |
|--|---|
| <ul style="list-style-type: none"><li>Given 1 breath every 5 to 6 seconds (about 10 to 12 breaths per minute)</li></ul>  | <ul style="list-style-type: none"><li>Given 1 breath every 3 to 5 seconds (about 12 to 20 breaths per minute)</li></ul> |
| <ul style="list-style-type: none"><li>Give each breath in 1 second</li><li>Each breath should result in visible chest rise</li><li>Check the pulse about every 2 minutes</li></ul> |   |

### Relieving Choking in a Responsive or an Unresponsive Victim 1 year of Age or Older

A choking victim initially may be responsive and then become unresponsive. In this circumstance you know that choking caused the victim's symptoms, and you know to look for a foreign object in the throat.

If the choking victim is responsive, use abdominal thrusts to relieve choking in an adult or child. Do not use abdominal thrusts in an infant.

If a choking victim becomes unresponsive, activate the emergency response system. Lower the victim to the ground and begin CPR, starting with compressions (do not check for a pulse)

For adults or child victim, every time you open the airway you give breaths, open the victim's mouth wide and look for the object. If you see an object that can easily be moved, move it with your fingers. If you do not see an object, keep doing CPR. After about 5 cycles or 2 minutes of CPR, activate the emergency response system if someone has not already done so.

Sometimes the choking victim may be unresponsive when you first encounter him or her. In this circumstance you probably will not know that an airway obstruction exists. Activate the emergency response system and start CPR (C-A-B sequence).

### Team Dynamics

Effective communication between team members of a multirescuer resuscitation give victims the best chance of survival. Good communication and effective team dynamics are the hallmarks of a successful resuscitation. Elements of effective team dynamics include:

- Roles during a resuscitation attempt
- What to communicate
- How to communicate

Effective team members should know their role and responsibility, what to communicate, and how to communicate. Team members should display mutual respect and professionalism to every other team member at all times.



| Component   | Recommendations   |   |  |
|---|---|---|--|
|   | Adult   | Children  | Infants  |
| Scene Safety  | Make sure the environment is safe for rescuers and victim   |   |  |
| Recognition   | Check for responsiveness (for all ages)   |   |  |
|   | No breathing or no normal breathing (i.e., only gasping)<br>No definite pulse felt within 10 seconds<br>(Breathing and pulse can be performed simultaneously in less than 10 secs)  |   |  |
| Activation of emergency response system               | If you are alone with no mobile phone, leave the victim to activate the emergency response system and get the AED before beginning CPR<br>Otherwise, send someone and begin CPR immediately; use the AED as soon as it is available | <b>Witnessed collapsed</b><br>Follow steps for adults and adolescents on the left.<br><b>Unwitnessed collapse</b><br>Give 2 minutes of CPR<br>Leave the victim to activate the emergency response system and get the AED<br>Return to the child or infant and resume CPR, use the AED as soon as it is available. |  |
| CPR Sequence  | Chest Compressions, Airway, Breathing (C-A-B)   |   |  |
| Compression-ventilation ratio without advanced airway | <b>1 or 2 rescuers</b><br>30:2  | <b>1 rescuer</b><br>30:2<br><b>2 or more rescuers</b><br>15:2   |  |
| Compression-ventilation ratio with advanced airway    | Continuous compressions at a rate of 100-120/min<br>Give 1 breath every 6 seconds (10 breaths/min)  |   |  |
| Compression Rate                                      | 100-120/min   |   |  |
| Compression Depth                                     | At least 2 inches (5cm)*  | At least 1/3 AP diameter<br>About 2 inches (5cm)  | At least 1/3 AP diameter<br>About 1 ½ inches (4cm)   |
| Hand Placement  | <b>2 hands on the lower half of the breastbone (sternum)</b>  | 2 hands or 1 hand (optional for very small child) on the lower half of the breastbone (sternum)   | <b>1 rescuer</b><br>2 fingers in the center of the chest, just below the nipple line<br><b>2 or more rescuers</b><br>2 thumb-encircling hands in the center of the chest, just below the nipple line |
| Chest wall recoil                                     | Allow complete recoil between compressions<br>Rotate compressors every 2 minutes  |   |  |
| Compression interruptions                             | Minimize interruptions in chest compressions<br>Attempt to limit interruptions to <10 seconds   |   |  |
| Airway  | Head tilt-chin lift (suspected trauma: jaw thrust)  |   |  |
| Defibrillation  | Attach and use AED as soon as available.<br>Minimize interruptions in chest compressions before and after shock;<br>Resume CPR beginning with compression immediately after each shock.   |   |  |



The American Heart Association strongly promotes knowledge and proficiency in BLS, ACLS, and PALS and has developed instructional materials for this purpose. Use this materials in an educational course does not represent course sponsorship by the American Heart Association.

*Credits:*

*All diagram and lingo  
taken from American  
Heart Association  
textbooks: BLS for  
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