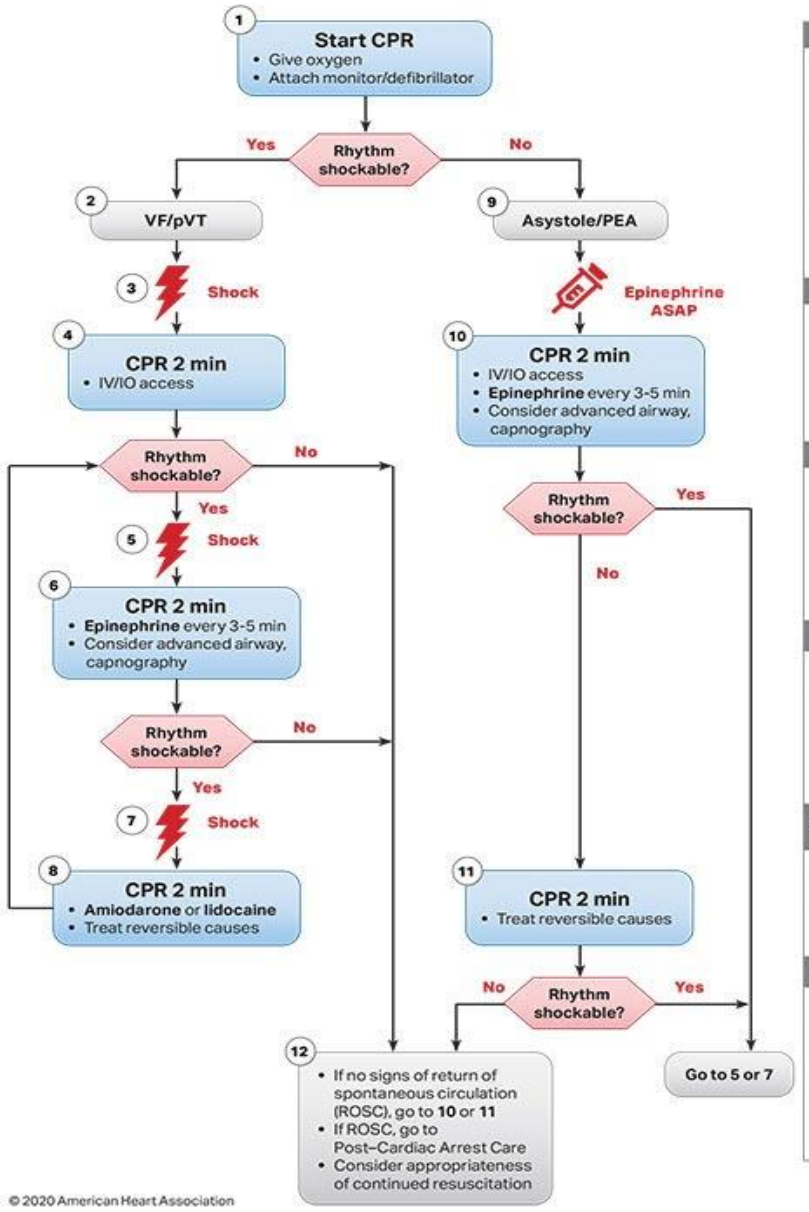

بسم الله الرحمن الرحيم
أثر ١٤٣٦
احسان الهستانية
١٣٩٤٠

Adult Advanced Cardiovascular Life Support

2020 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Adult Cardiac Arrest Algorithm (VF/pVT/Asystole/PEA)



CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If $PETCO_2$ is low or decreasing, reassess CPR quality.

Shock Energy for Defibrillation

- **Biphasic**: Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic**: 360 J

Drug Therapy

- **Epinephrine IV/IO dose:** 1 mg every 3-5 minutes
- **Amiodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg.
  or
  Lidocaine IV/IO dose: First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in $PETCO_2$ (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Recommendations for Compression Depth and Rate		
COR	**LOE**	**Recommendations**
1	B-NR	1. During manual CPR, rescuers should perform chest compressions to a depth of at least 2 inches, or 5 cm, for an average adult while avoiding excessive chest compression depths (greater than 2.4 inches, or 6 cm).
2a	B-NR	2. In adult victims of cardiac arrest, it is reasonable for rescuers to perform chest compressions at a rate of 100 to 120/min.
2a	C-LD	3. It can be beneficial for rescuers to avoid leaning on the chest between compressions to allow complete chest wall recoil for adults in cardiac arrest.
2b	C-EO	4. It may be reasonable to perform chest compressions so that chest compression and recoil/relaxation times are approximately equal.

Recommendations for Fundamentals of Ventilation During Cardiac Arrest		
COR	**LOE**	**Recommendations**
2a	C-LD	1. For adults in cardiac arrest receiving ventilation, tidal volumes of approximately 500 to 600 mL, or enough to produce visible chest rise, are reasonable.
2a	C-EO	2. In patients without an advanced airway, it is reasonable to deliver breaths either by mouth or by using bag-mask ventilation.
2b	C-EO	3. When providing rescue breaths, it may be reasonable to give 1 breath over 1 s, take a "regular" (not deep) breath, and give a second rescue breath over 1 s.
3: Harm	C-LD	4. Rescuers should avoid excessive ventilation (too many breaths or too large a volume) during CPR.

Recommendations for Compression-to-Ventilation Ratio: ALS		
COR	**LOE**	**Recommendations**
2a	B-R	1. Before placement of an advanced airway (supraglottic airway or tracheal tube), it is reasonable for healthcare providers to perform CPR with cycles of 30 compressions and 2 breaths.
2b	B-R	2. It may be reasonable for EMS providers to use a rate of 10 breaths per minute (1 breath every 6 s) to provide asynchronous ventilation during continuous chest compressions before placement of an advanced airway.
2b	C-LD	3. If an advanced airway is in place, it may be reasonable for the provider to deliver 1 breath every 6 s (10 breaths/min) while continuous chest compressions are being performed.
2b	C-LD	4. It may be reasonable to initially use minimally interrupted chest compressions (ie, delayed ventilation) for witnessed shockable OHCA as part of a bundle of care.

Recommendations for Defibrillation Indication, Type, and Energy		
COR	**LOE**	**Recommendations**
1	B-NR	1. Defibrillators (using biphasic or monophasic waveforms) are recommended to treat tachyarrhythmias requiring a shock.
2a	B-R	2. Based on their greater success in arrhythmia termination, defibrillators using biphasic waveforms are preferred over monophasic defibrillators for treatment of tachyarrhythmias.
2a	B-NR	3. A single shock strategy is reasonable in preference to stacked shocks for defibrillation in the setting of unmonitored cardiac arrest.
2a	C-LD	4. It is reasonable that selection of fixed versus escalating energy levels for subsequent shocks for presumed shock-refractory arrhythmias be based on the specific manufacturer's instructions for that waveform. If this is not known, defibrillation at the maximal dose may be considered.
2b	B-R	5. If using a defibrillator capable of escalating energies, higher energy for second and subsequent shocks may be considered for presumed shock-refractory arrhythmias.
2b	C-LD	6. In the absence of conclusive evidence that one biphasic waveform is superior to another in termination of VF, it is reasonable to use the manufacturer's recommended energy dose for the first shock. If this is not known, defibrillation at the maximal dose may be considered.

Recommendation for Pads for Defibrillation		
COR	**LOE**	**Recommendation**
2a	C-LD	1. It is reasonable to place defibrillation paddles or pads on the exposed chest in an anterolateral or anteroposterior position, and to use a paddle or pad electrode diameter more than 8 cm in adults.

Recommendation for Automatic- Versus Manual-Mode Defibrillation		
COR	**LOE**	**Recommendation**
2b	C-LD	1. It may be reasonable to use a defibrillator in manual mode as compared with automatic mode depending on the skill set of the operator.

Recommendations for CPR Before Defibrillation		
COR	**LOE**	**Recommendations**
1	C-LD	1. CPR is recommended until a defibrillator or AED is applied.
2a	B-R	2. In unmonitored cardiac arrest, it is reasonable to provide a brief prescribed period of CPR while a defibrillator is being obtained and readied for use before initial rhythm analysis and possible defibrillation.
2a	C-LD	3. Immediate defibrillation is reasonable for provider-witnessed or monitored VF/pVT of short duration when a defibrillator is already applied or immediately available.

Recommendation for Postshock Rhythm Check		
COR	**LOE**	**Recommendation**
2b	C-LD	1. It may be reasonable to immediately resume chest compressions after shock administration rather than pause CPR to perform a postshock rhythm check in cardiac arrest patients.

Recommendation for Double Sequential Defibrillation		
COR	**LOE**	**Recommendation**
2b	C-LD	1. The usefulness of double sequential defibrillation for refractory shockable rhythm has not been established.

Recommendations for Vascular Access in Cardiac Arrest Management		
COR	**LOE**	**Recommendations**
2a	B-NR	1. It is reasonable for providers to first attempt establishing intravenous access for drug administration in cardiac arrest.
2b	B-NR	2. Intraosseous access may be considered if attempts at intravenous access are unsuccessful or not feasible.
2b	C-LD	3. In appropriately trained providers, central venous access may be considered if attempts to establish intravenous and intraosseous access are unsuccessful or not feasible.
2b	C-LD	4. Endotracheal drug administration may be considered when other access routes are not available.

Recommendations for Vasopressor Management in Cardiac Arrest		
COR	**LOE**	**Recommendations**
1	B-R	1. We recommend that epinephrine be administered for patients in cardiac arrest.
2a	B-R	2. Based on the protocols used in clinical trials, it is reasonable to administer epinephrine 1 mg every 3 to 5 min for cardiac arrest.
2a	C-LD	3. With respect to timing, for cardiac arrest with a nonshockable rhythm, it is reasonable to administer epinephrine as soon as feasible.
2b	C-LD	4. With respect to timing, for cardiac arrest with a shockable rhythm, it may be reasonable to administer epinephrine after initial defibrillation attempts have failed.
2b	C-LD	5. Vasopressin alone or vasopressin in combination with epinephrine may be considered in cardiac arrest but offers no advantage as a substitute for epinephrine in cardiac arrest.
3: No Benefit	B-R	6. High-dose epinephrine is not recommended for routine use in cardiac arrest.

Recommendations for Nonvasopressor Medications		
COR	**LOE**	**Recommendations**
2b	B-R	1. Amiodarone or lidocaine may be considered for VF/pVT that is unresponsive to defibrillation.
2b	C-LD	2. For patients with OHCA, use of steroids during CPR is of uncertain benefit.
3: No Benefit	B-NR	3. Routine administration of calcium for treatment of cardiac arrest is not recommended.
3: No Benefit	B-R	4. Routine use of sodium bicarbonate is not recommended for patients in cardiac arrest.
3: No Benefit	B-R	5. The routine use of magnesium for cardiac arrest is not recommended.

Recommendations for Adjuncts to CPR		
COR	**LOE**	**Recommendations**
2b	C-LD	1. If an experienced sonographer is present and use of ultrasound does not interfere with the standard cardiac arrest treatment protocol, then ultrasound may be considered as an adjunct to standard patient evaluation, although its usefulness has not been well established.
2b	C-LD	2. When supplemental oxygen is available, it may be reasonable to use the maximal feasible inspired oxygen concentration during CPR.
2b	C-LD	3. An abrupt increase in end-tidal CO_2 may be used to detect ROSC during compressions or when a rhythm check reveals an organized rhythm.
2b	C-EO	4. Routine measurement of arterial blood gases during CPR has uncertain value.
2b	C-EO	5. Arterial pressure monitoring by arterial line may be used to detect ROSC during chest compressions or when a rhythm check reveals an organized rhythm.

Recommendations for Termination of Resuscitation		
COR	**LOE**	**Recommendations**
1	B-NR	1. If termination of resuscitation (TOR) is being considered, BLS EMS providers should use the BLS termination of resuscitation rule where ALS is not available or may be significantly delayed.
2a	B-NR	2. It is reasonable for prehospital ALS providers to use the adult ALS TOR rule to terminate resuscitation efforts in the field for adult victims of OHCA.
2a	B-NR	3. In a tiered ALS- and BLS-provider system, the use of the BLS TOR rule can avoid confusion at the scene of a cardiac arrest without compromising diagnostic accuracy.
2b	C-LD	4. In intubated patients, failure to achieve an end-tidal CO_2 of greater than 10 mm Hg by waveform capnography after 20 min of ALS resuscitation may be considered as a component of a multimodal approach to decide when to end resuscitative efforts, but it should not be used in isolation.
3: No Benefit	C-LD	5. We suggest against the use of point-of-care ultrasound for prognostication during CPR.
3: Harm	C-EO	6. In nonintubated patients, a specific end-tidal CO_2 cutoff value at any time during CPR should not be used as an indication to end resuscitative efforts.

Recommendations for Choice of Advanced Airway Device: Endotracheal Intubation Versus Supraglottic Airway		
COR	**LOE**	**Recommendations**
2a	B-R	1. If an advanced airway is used, a supraglottic airway can be used for adults with OHCA in settings with low tracheal intubation success rates or minimal training opportunities for endotracheal tube placement.
2a	B-R	2. If an advanced airway is used, either a supraglottic airway or endotracheal intubation can be used for adults with OHCA in settings with high tracheal intubation success rates or optimal training opportunities for endotracheal tube placement.
2a	B-R	3. If an advanced airway is used in the in-hospital setting by expert providers trained in these procedures, either a supraglottic airway or an endotracheal tube placement can be used.

Recommendations for Advanced Airway Placement Considerations		
COR	**LOE**	**Recommendations**
1	B-NR	1. Frequent experience or frequent retraining is recommended for providers who perform endotracheal intubation.
1	C-LD	2. If advanced airway placement will interrupt chest compressions, providers may consider deferring insertion of the airway until the patient fails to respond to initial CPR and defibrillation attempts or obtains ROSC.
1	C-LD	3. Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an endotracheal tube.
1	C-EO	4. EMS systems that perform prehospital intubation should provide a program of ongoing quality improvement to minimize complications and track overall supraglottic airway and endotracheal tube placement success rates.

Recommendations for Mechanical CPR Devices		
COR	**LOE**	**Recommendations**
2b	C-LD	1. The use of mechanical CPR devices may be considered in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the provider, as long as rescuers strictly limit interruptions in CPR during deployment and removal of the device.
3: No Benefit	B-R	2. The routine use of mechanical CPR devices is not recommended.

Oxygen Dose During CPR

- ✓The immediate goals of CPR are to restore the energy state of the heart so it can resume mechanical work and to maintain the energy state of the brain to minimize ischemic injury.
- ✓Adequate oxygen delivery is necessary to achieve these goals.
- ✓Oxygen delivery is dependent on both blood flow and arterial oxygen content.
- ✓Because blood flow is typically the major limiting factor to oxygen delivery during CPR, it is theoretically important to maximize the oxygen content of arterial blood by maximizing inspired oxygen concentration.

- ✓Until further data are available, physiology and expert consensus support providing the **maximal inspired oxygen concentration during** CPR.

Monitoring Physiologic Parameters During CPR

- ✓Animal and human studies indicate that monitoring physiologic parameters during CPR provides valuable information about the patient's condition and response to therapy.

- ✓Most important, end-tidal CO2 (etco2), coronary perfusion pressure, arterial blood pressure, and central venous oxygen saturation.

- ✓An abrupt increase in any of these parameters is a sensitive indicator of ROSC.

- ✓it may be reasonable to use physiologic parameters to monitor and optimize CPR quality, guide vasopressor therapy, and detect ROSC.

Ultrasound During Cardiac Arrest

- ✓Ultrasound may be applied to patients receiving CPR to help assess myocardial contractility and to help identify potentially treatable causes of cardiac arrest such as hypovolemia, pneumothorax, pulmonary thromboembolism, or pericardial tamponade.

- ✓If a qualified sonographer is present and use of ultrasound does not interfere with the standard cardiac arrest treatment protocol, then ultrasound may be considered as an adjunct to standard patient evaluation (Class IIb, LOE C-EO).

Bag-Mask Ventilation Compared With Any Advanced Airway During CPRALS

- ✓When cardiac arrest occurs, providers must determine the best way to support ventilation and oxygenation.

- ✓Options include standard bag-mask ventilation versus the placement of an advanced airway (ie, endotracheal tube [ETT], supraglottic airway device [SGA]).

- ✓There is inadequate evidence to show a difference in survival or favorable neurologic outcome with the use of bag-mask ventilation compared with endotracheal intubation or other advanced airway devices.

- ✓Placement of an advanced airway may result in interruption of chest compressions, and the ideal timing of placement to maximize outcome has not been adequately studied.

- ✓Risks of endotracheal intubation during resuscitation include unrecognized esophageal intubation and increased hands-off time.

- ✓The choice of bag-mask device versus advanced airway insertion, then, will be determined by the skill and experience of the provider.

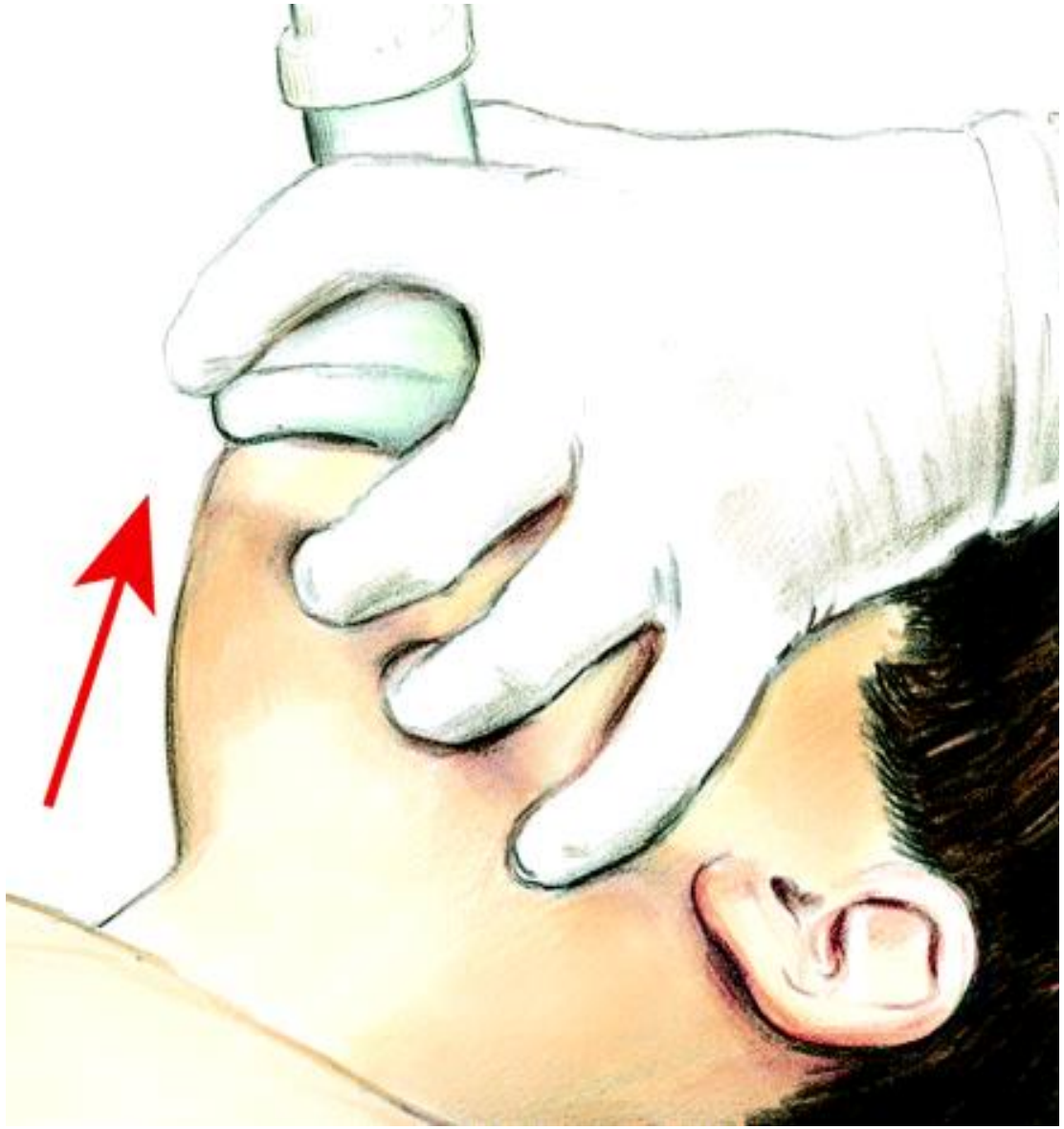
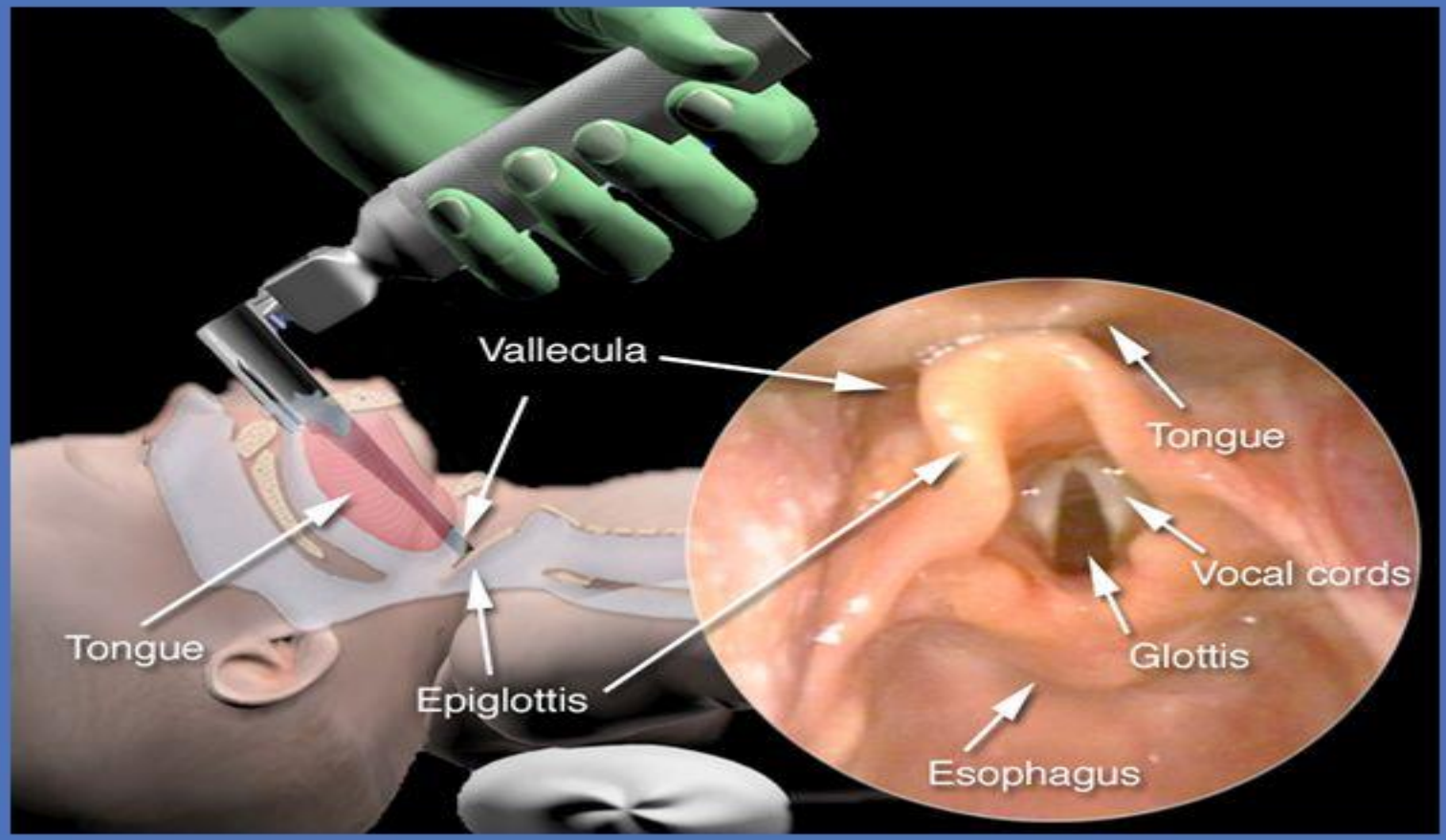


Figure 2: The Two-hand Thenar Eminence technique of Bag-Mask-Ventilation.

Endotracheal Intubation: Anatomic Landmarks



Clinical Assessment of Tracheal Tube Placement

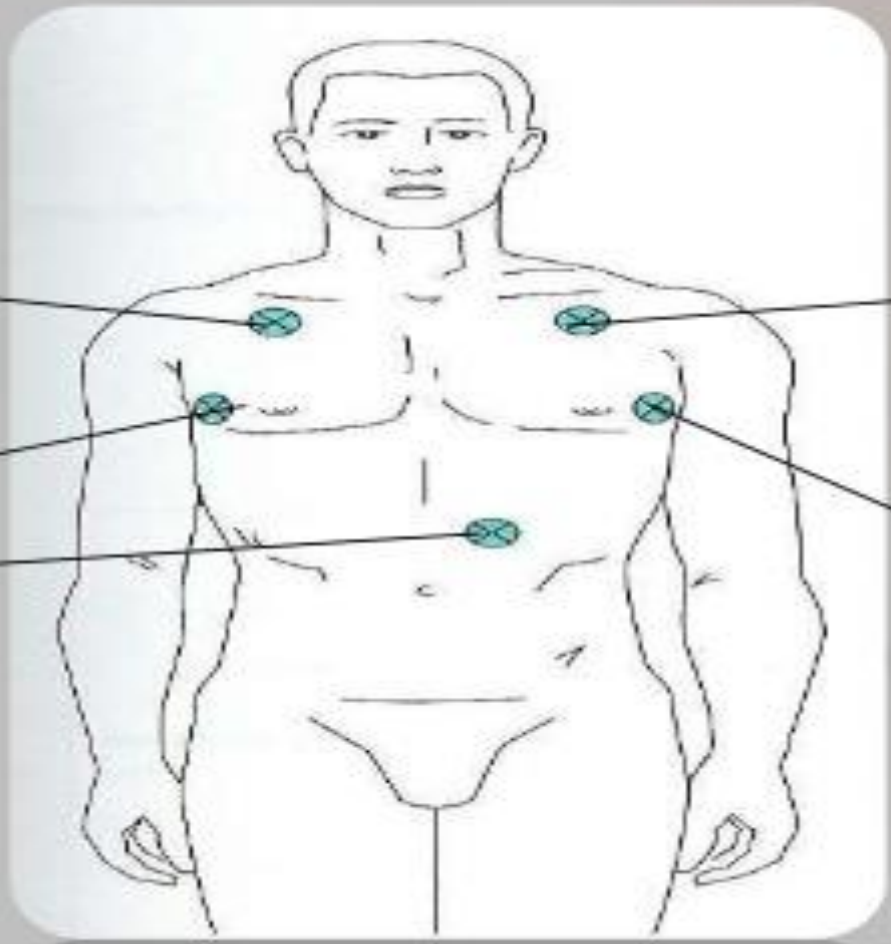
- ✓In addition to auscultation of the lungs and stomach, several methods (eg, waveform capnography, esophageal detector device, tracheal ultrasound, fiberoptic bronchoscopy) have been proposed to confirm successful tracheal intubation in adults during cardiac arrest.
- ✓Observational studies and 1 small randomized study of waveform capnography to verify ETT position in victims of cardiac arrest report a specificity of 100% for correct tube placement.
- ✓False-negative results (ie, absent exhaled CO2 in the presence of tracheal intubation) can occur in the setting of pulmonary embolism, significant hypotension, contamination of the detector with gastric contents, and severe airflow obstruction.

- ✓Unlike capnography, confirmation of ETT placement via ultrasonography is not dependent on adequate pulmonary blood flow and CO2 in exhaled gas.

- ✓Continuous waveform capnography is recommended in addition to clinical assessment as the **most reliable method of confirming** and monitoring correct placement of an ETT (Class I, LOE C-LD).

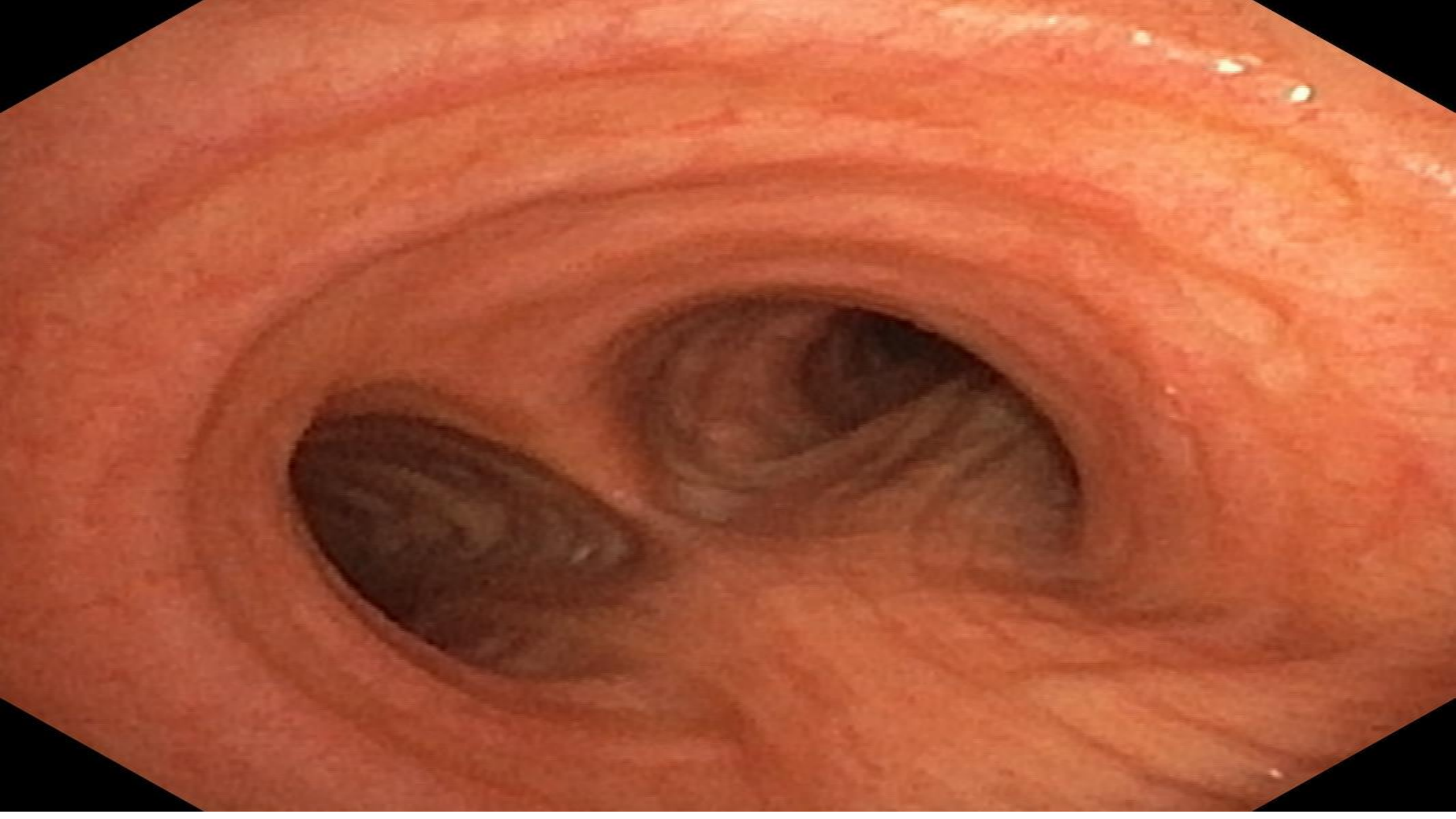
Post-intubation auscultation

1. Right infra-clavicular
2. Left infra-clavicular
3. Right infra-mammary
4. Left infra-mammary
5. Gastric

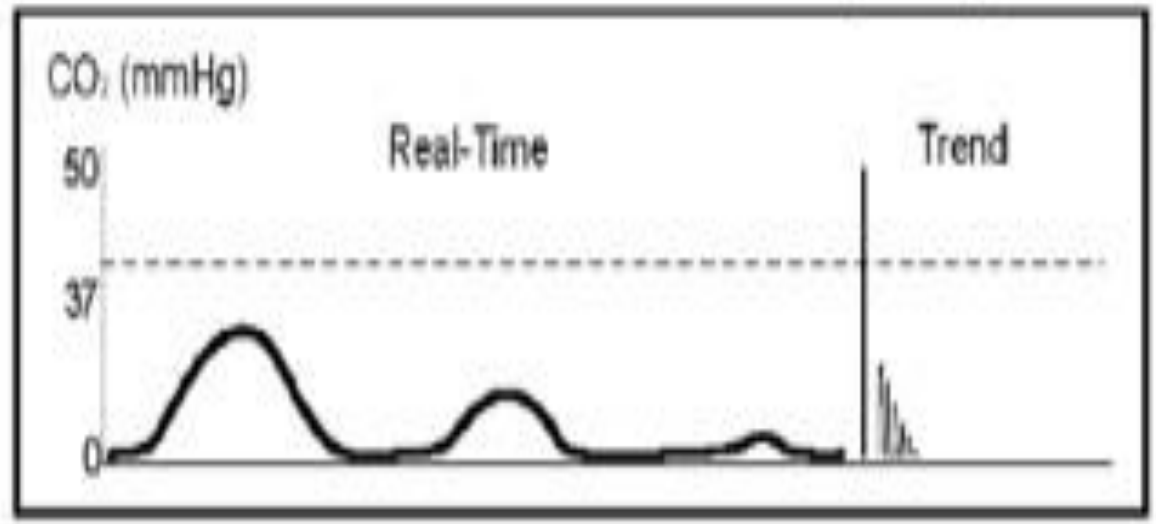


Direct - Oesophageal Intubation


4
2
1
3



Endotracheal Tube in Esophagus



Possible Causes:

- Missed intubation
- A normal capnogram is the best evidence that the ET tube is correctly positioned
- With ET tube in the esophagus, little or no CO_2 is present

Ventilation After Advanced Airway Placement

✓Except for respiratory rate, it is unknown whether monitoring ventilatory parameters (eg, minute ventilation, peak pressure) during CPR can influence outcome.

✓Positive pressure ventilation increases intrathoracic pressure and may reduce venous return and cardiac output, especially in patients with hypovolemia or obstructive airway disease.

✓After placement of an advanced airway, it may be reasonable for the provider to deliver 1 breath every 6 seconds **(10 breaths/min**) while continuous chest compressions are being performed (Class IIb, LOE C-LD).

Thank you