

BASIC & ADVANCED LIFE SUPPORT UPDATES 2020

EDITED & COLLECTED BY

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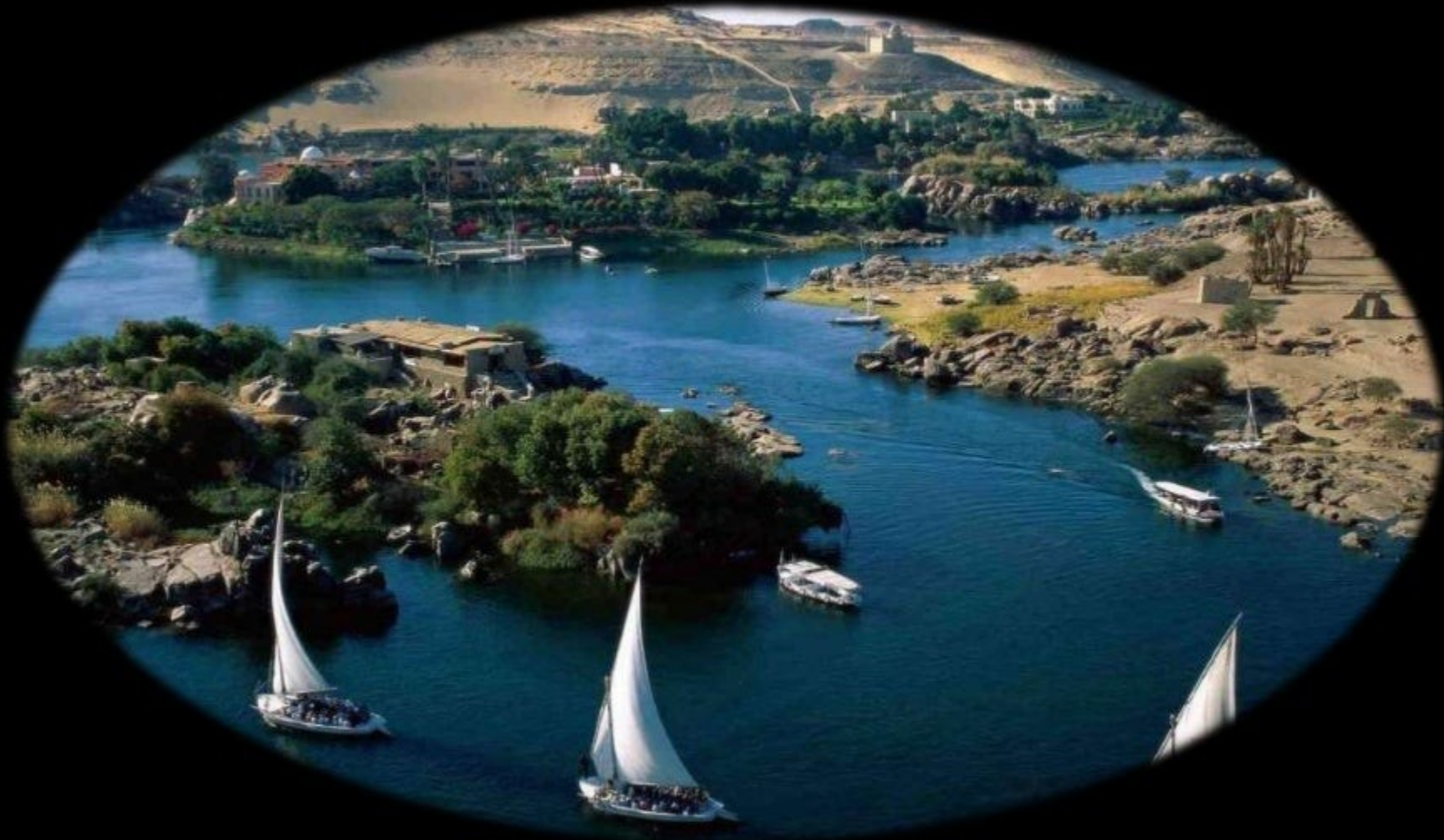


Figure 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care (Updated May 2019)*

CLASS (STRENGTH) OF RECOMMENDATION		LEVEL (QUALITY) OF EVIDENCE†
CLASS 1 (STRONG) Benefit >>> Risk		LEVEL A
Suggested phrases for writing recommendations: • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases: – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B		• High-quality evidence‡ from more than 1 RCT • Meta-analyses of high-quality RCTs • One or more RCTs corroborated by high-quality registry studies
CLASS 2a (MODERATE) Benefit >> Risk		LEVEL B-R (Randomized)
Suggested phrases for writing recommendations: • Is reasonable • Can be useful/effective/beneficial • Comparative-Effectiveness Phrases: – Treatment/strategy A is probably recommended/indicated in preference to treatment B – It is reasonable to choose treatment A over treatment B		• Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs
CLASS 2b (WEAK) Benefit ≥ Risk		LEVEL B-NR (Nonrandomized)
Suggested phrases for writing recommendations: • May/might be reasonable • May/might be considered • Usefulness/effectiveness is unknown/unclear/uncertain or not well-established		• Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies • Meta-analyses of such studies
CLASS 3: No Benefit (MODERATE) (Generally, LOE A or B use only) Benefit = Risk		LEVEL C-LD (Limited Data)
Suggested phrases for writing recommendations: • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other		• Randomized or nonrandomized observational or registry studies with limitations of design or execution • Meta-analyses of such studies • Physiological or mechanistic studies in human subjects
Class 3: Harm (STRONG) Risk > Benefit		LEVEL C-EO (Expert Opinion)
Suggested phrases for writing recommendations: • Potentially harmful • Causes harm • Associated with excess morbidity/mortality • Should not be performed/administered/other		• Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

- * The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).
- † For comparative-effectiveness recommendations (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.
- ‡ The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

Overview Concepts of Adult Cardiac Arrest

The main focus in adult cardiac arrest events includes rapid recognition, prompt provision of CPR, defibrillation of malignant shockable rhythms, and post-ROSC supportive care and treatment of underlying causes

Adult Chain of Survival

Figure 3. AHA Chains of Survival for adult IHCA and OHCA.

IHCA



OHCA

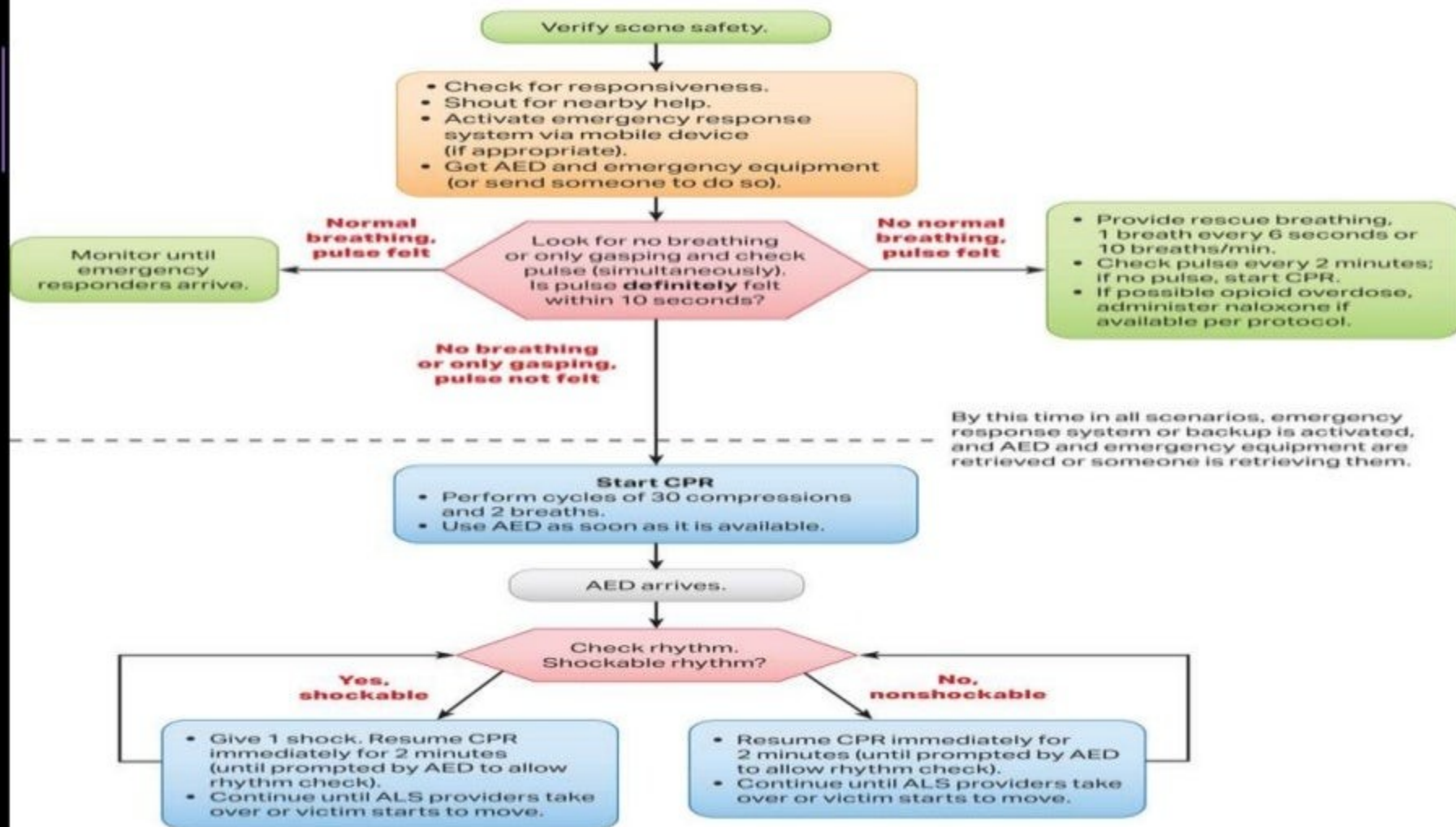


Table 2. Adult BLS Sequence²²

Step	Lay Rescuer Not Trained	Lay Rescuer Trained	Healthcare Provider
1	Ensure scene safety.	Ensure scene safety.	Ensure scene safety.
2	Check for response.	Check for response.	Check for response.
3	Shout for nearby help. Phone or ask someone to phone 9-1-1 (the phone or caller with the phone remains at the victim's side, with the phone on speaker mode).	Shout for nearby help and activate the emergency response system (9-1-1, emergency response). If someone responds, ensure that the phone is at the side of the victim if at all possible.	Shout for nearby help/activate the resuscitation team; the provider can activate the resuscitation team at this time or after checking for breathing and pulse.

4	Follow the telecommunicator's* instructions.	Check for no breathing or only gasping; if none, begin CPR with compressions.	Check for no breathing or only gasping and check pulse (ideally simultaneously). Activation and retrieval of the AED/emergency equipment by the lone healthcare provider or by the second person sent by the rescuer must occur no later than immediately after the check for no normal breathing and no pulse identifies cardiac arrest.
5	Look for no breathing or only gasping, at the direction of the telecommunicator.	Answer the telecommunicator's questions, and follow the telecommunicator's instructions.	Immediately begin CPR, and use the AED/defibrillator when available.
6	Follow the telecommunicator's instructions.	Send the second person to retrieve an AED, if one is available.	When the second rescuer arrives, provide 2-rescuer CPR and use the AED/defibrillator.

Adult Basic Life Support Algorithm for Healthcare Providers



Adult Cardiac Arrest Circular Algorithm



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 PETCO₂ 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.
- **Lidocaine IV/IO dose:** First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

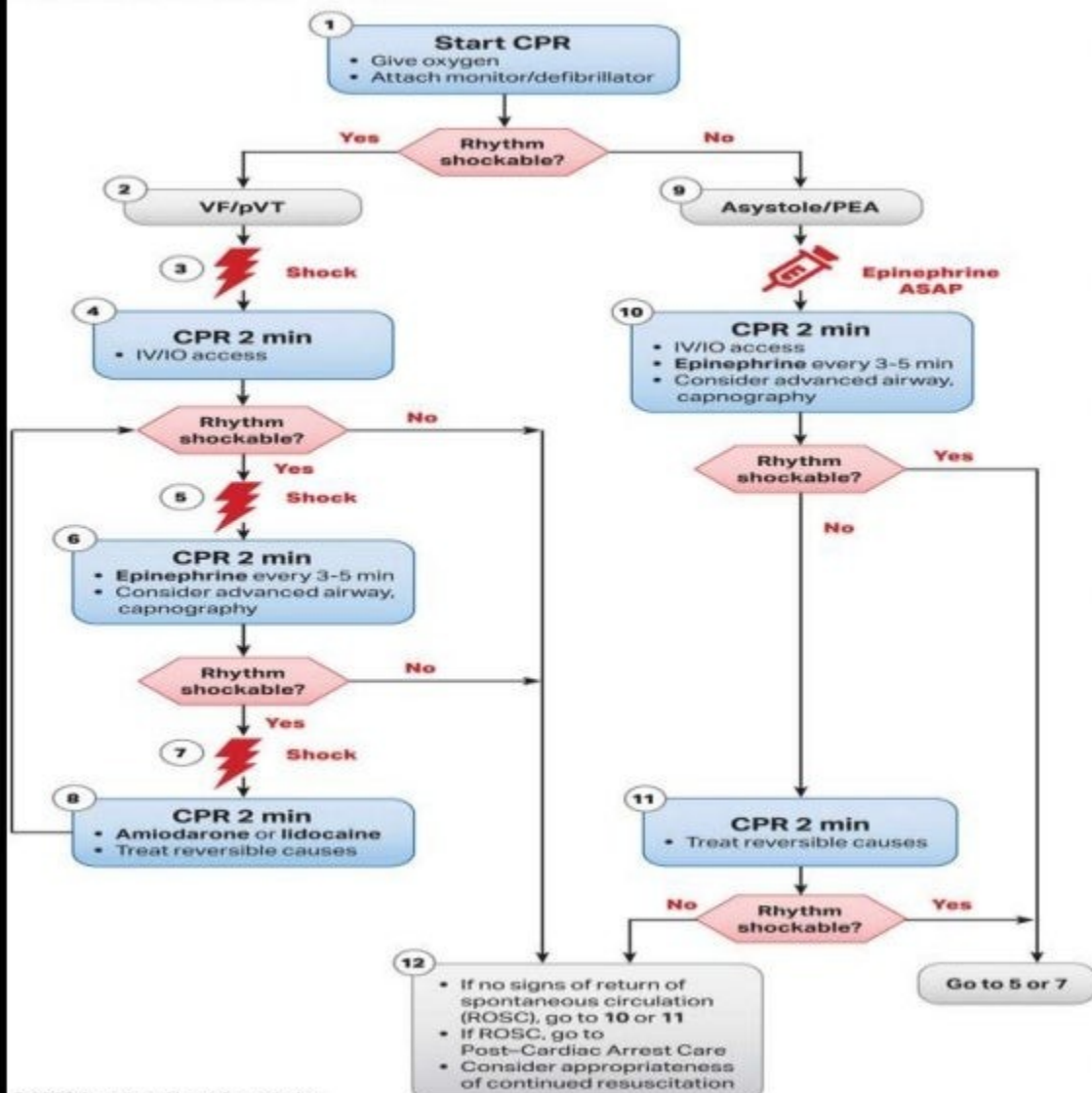
- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in PETCO₂ (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- | | |
|---------------------------|-------------------------|
| • Hypovolemia | • Tension pneumothorax |
| • Hypoxia | • Tamponade, cardiac |
| • Hydrogen ion (acidosis) | • Toxins |
| • Hypo-/hyperkalemia | • Thrombosis, pulmonary |
| • Hypothermia | • Thrombosis, coronary |



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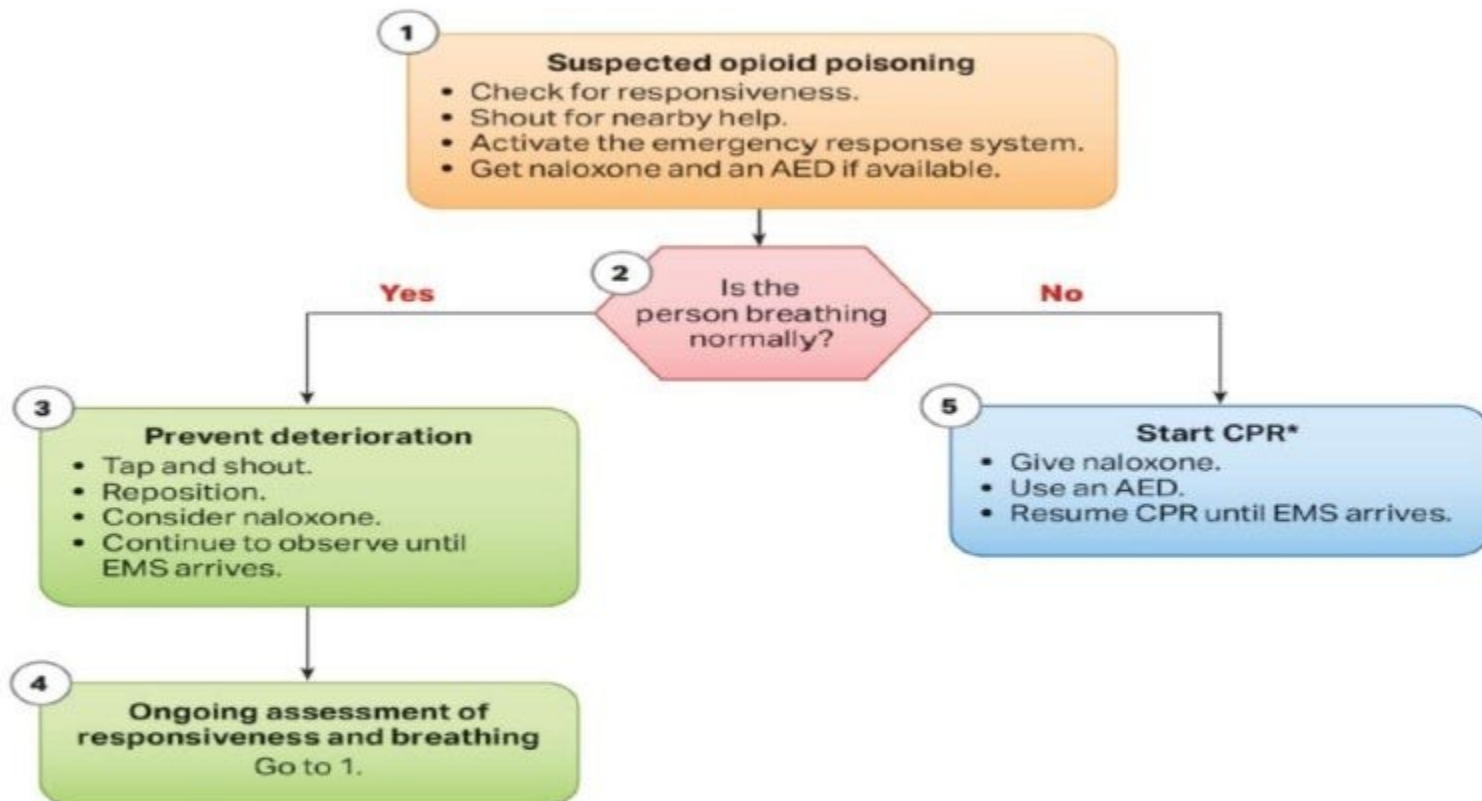
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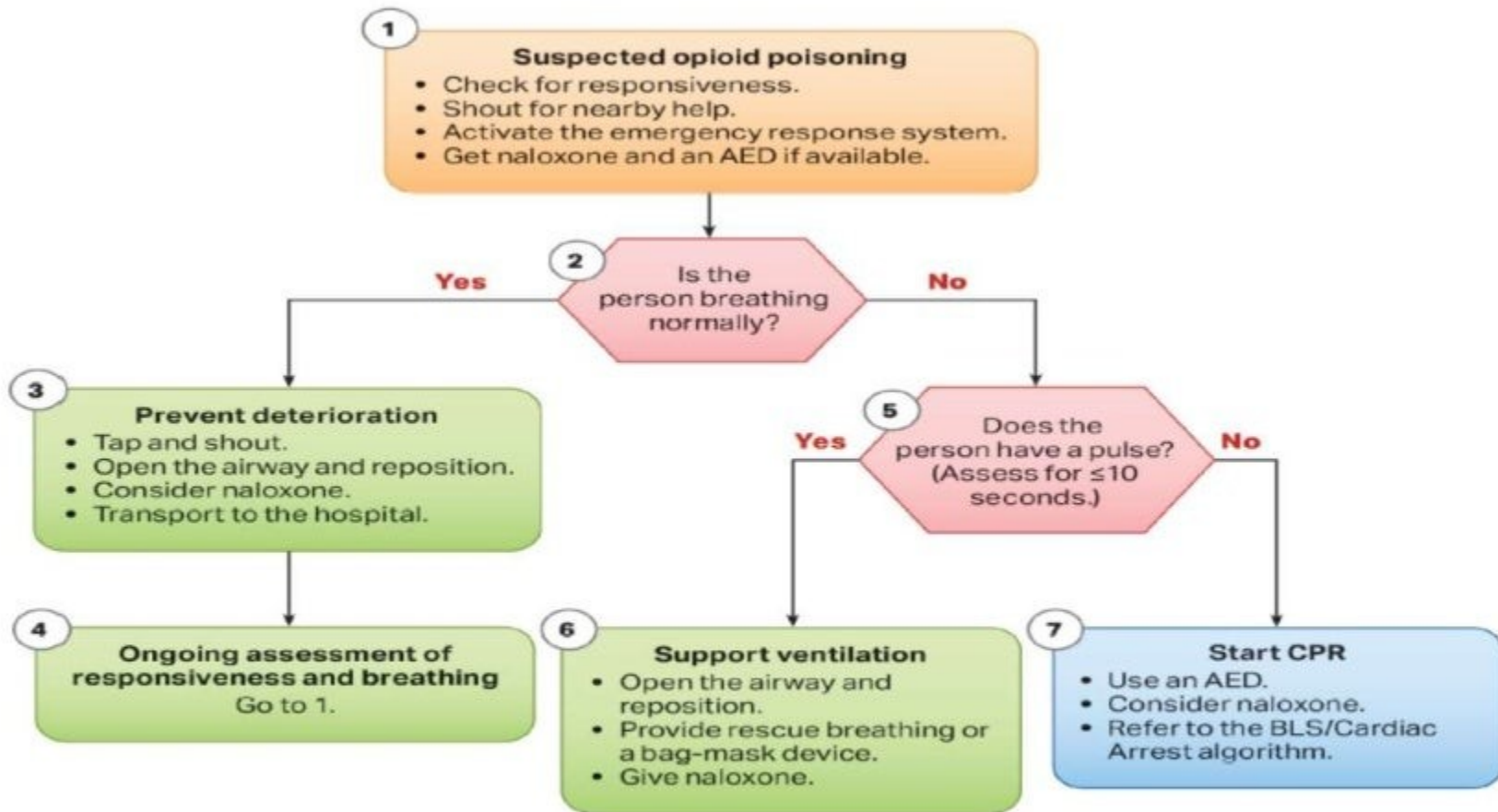
Figure 5. Opioid-Associated Emergency for Lay Responders Algorithm.



*For adult and adolescent victims, responders should perform compressions and rescue breaths for opioid-associated emergencies if they are trained and perform Hands-Only CPR if not trained to perform rescue breaths. For infants and children, CPR should include compressions with rescue breaths.

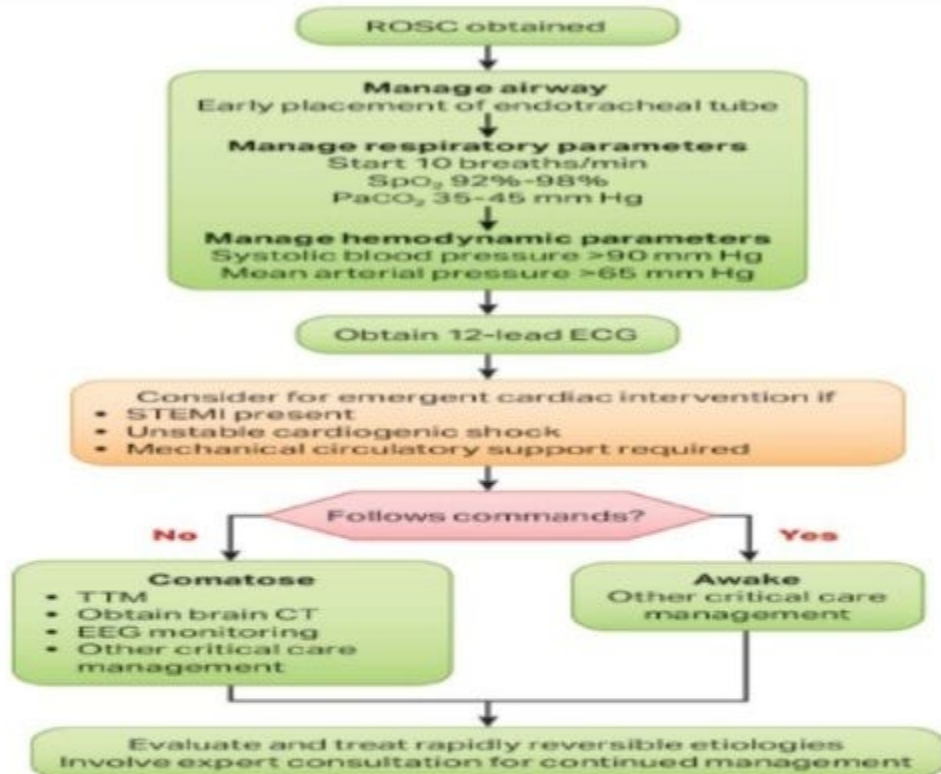
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Figure 6. Opioid-Associated Emergency for Healthcare Providers Algorithm.



Initial Stabilization Phase

Continued Management and Additional Emergent Activities



Initial Stabilization Phase

Resuscitation is ongoing during the post-ROSC phase, and many of these activities can occur concurrently. However, if prioritization is necessary, follow these steps:

- **Airway management:** Waveform capnography or capnometry to confirm and monitor endotracheal tube placement
- **Manage respiratory parameters:** Titrate FiO_2 for SpO_2 92%-98%; start at 10 breaths/min; titrate to PaCO_2 of 35-45 mm Hg
- **Manage hemodynamic parameters:** Administer crystalloid and/or vasopressor or inotrope for goal systolic blood pressure >90 mm Hg or mean arterial pressure >65 mm Hg

Continued Management and Additional Emergent Activities

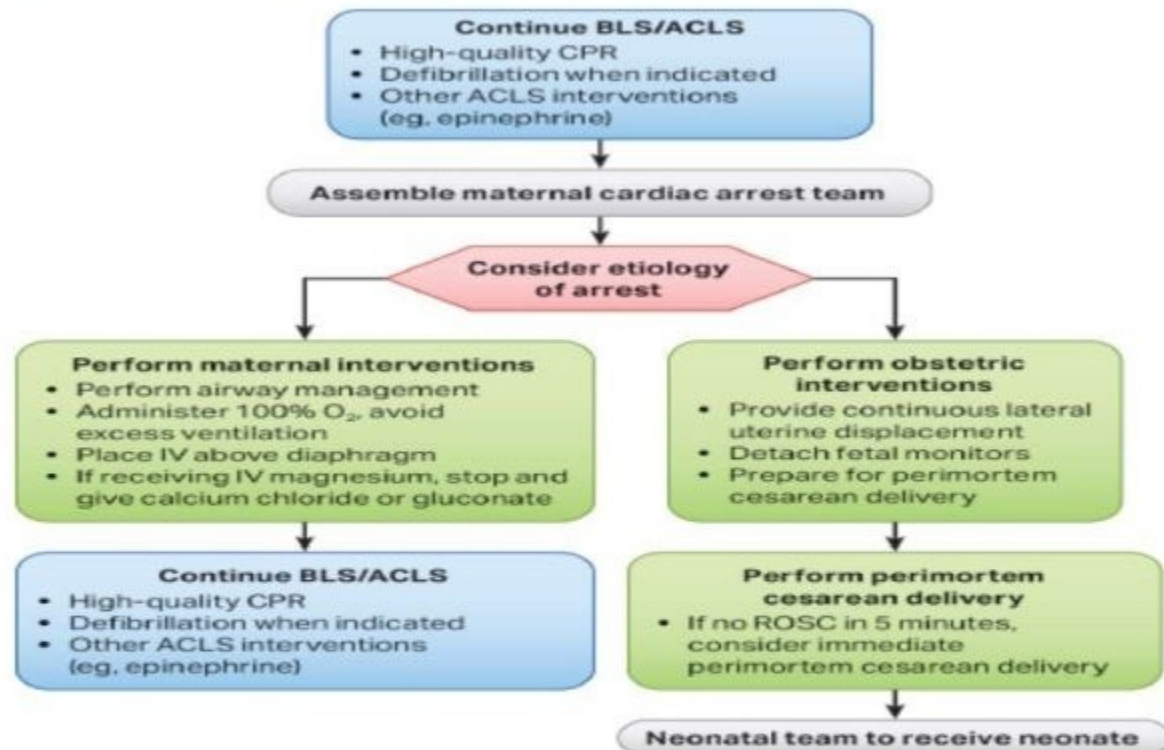
These evaluations should be done concurrently so that decisions on targeted temperature management (TTM) receive high priority as cardiac interventions.

- **Emergent cardiac intervention:** Early evaluation of 12-lead electrocardiogram (ECG); consider hemodynamics for decision on cardiac intervention
- **TTM:** If patient is not following commands, start TTM as soon as possible; begin at 32-36°C for 24 hours by using a cooling device with feedback loop
- **Other critical care management**
 - Continuously monitor core temperature (esophageal, rectal, bladder)
 - Maintain normoxia, normocapnia, euglycemia
 - Provide continuous or intermittent electroencephalogram (EEG) monitoring
 - Provide lung-protective ventilation

H's and T's

Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypokalemia/hyperkalemia
Hypothermia
Tension pneumothorax
Tamponade, cardiac
Toxins
Thrombosis, pulmonary
Thrombosis, coronary

Figure 9. Cardiac Arrest in Pregnancy In-Hospital ACLS Algorithm.



Maternal Cardiac Arrest

- Team planning should be done in collaboration with the obstetric, neonatal, emergency, anesthesiology, intensive care, and cardiac arrest services.
- Priorities for pregnant women in cardiac arrest should include provision of high-quality CPR and relief of aortocaval compression with lateral uterine displacement.
- The goal of perimortem cesarean delivery is to improve maternal and fetal outcomes.
- Ideally, perform perimortem cesarean delivery in 5 minutes, depending on provider resources and skill sets.

Advanced Airway

- In pregnancy, a difficult airway is common. Use the most experienced provider.
- Provide endotracheal intubation or supraglottic advanced airway.
- Perform waveform capnography or capnometry to confirm and monitor ET tube placement.
- Once advanced airway is in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions.

Potential Etiology of Maternal Cardiac Arrest

- A** Anesthetic complications
- B** Bleeding
- C** Cardiovascular
- D** Drugs
- E** Embolic
- F** Fever
- G** General nonobstetric causes of cardiac arrest (H's and T's)
- H** Hypertension

Airway

1. A healthcare provider should use the head tilt-chin lift maneuver to open the airway of a patient when no cervical spine injury is suspected
2. The trained lay rescuer who feels confident in performing both compressions and ventilation should open the airway using a head tilt-chin lift maneuver when no cervical spine injury is suspected.
3. The use of an airway adjunct (eg, oropharyngeal and/or nasopharyngeal airway) may be reasonable in unconscious (unresponsive) patients with no cough or gag reflex to facilitate delivery of ventilation with a bag-mask device.

Airway with head trauma

In cases of suspected cervical spine injury, healthcare providers should open the airway by using a jaw thrust without head extension.

In the setting of head and neck trauma, a head tilt-chin lift maneuver should be performed if the airway cannot be opened with a jaw thrust and airway adjunct insertion.

compression

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).

The diagram consists of two circular nodes connected by two arrows. The left node is red and contains text about compression depth. The right node is blue and contains text about compression rate. A purple arrow points from the red node to the blue node, and a green arrow points from the blue node back to the red node, forming a cycle.

In adult victims of cardiac arrest, it is reasonable for rescuers to perform chest compressions at a rate of 100 to 120/min.

ventilation

For adults in cardiac arrest receiving ventilation, tidal volumes of approximately 500 to 600 mL, or enough to produce visible chest rise, are reasonable

In patients without an advanced airway, it is reasonable to deliver breaths either by mouth or by using bag-mask ventilation

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.

It is reasonable for a rescuer to use mouth-to-nose ventilation if ventilation through the victim's mouth is impossible or impractical.

Rescue breathing

1. If an adult victim with spontaneous circulation (ie, strong and easily palpable pulses) requires support of ventilation, it may be reasonable for the healthcare provider to give rescue breaths at a rate of about 1 breath every 6 s, or about 10 breaths per minute

Compression –ventilation

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.

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

Defibrillation



early defibrillation is critical to survival when sudden cardiac arrest is caused by VF or pulseless VT (pVT).^{1,2} Defibrillation is most successful when administered as soon as possible after onset of VF/VT and a reasonable immediate treatment when the interval from onset to shock is very brief.

Defibrillators (using biphasic or monophasic waveforms) are recommended to treat tachyarrhythmias requiring a shock.

Based on their greater success in arrhythmia termination, defibrillators using biphasic waveforms are preferred over monophasic defibrillators for treatment of tachyarrhythmias.

A single shock strategy is reasonable in preference to stacked shocks for defibrillation in the setting of unmonitored cardiac arrest.

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.

Pseudo-Electric Therapies for Cardiac Arrest

Recommendations for Precordial Thump

COR	LOE	Recommendations
2b	B-NR	1. The precordial thump may be considered at the onset of a rescuer-witnessed, monitored, unstable ventricular tachyarrhythmia when a defibrillator is not immediately ready for use and is performed without delaying CPR or shock delivery.
3: No Benefit	C-LD	2. The precordial thump should not be used routinely for established cardiac arrest.

Vascular Access

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.

Vasopressor in cardiac arrest

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.

Nonvasopressor Medications During 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.

CPR adjuncts

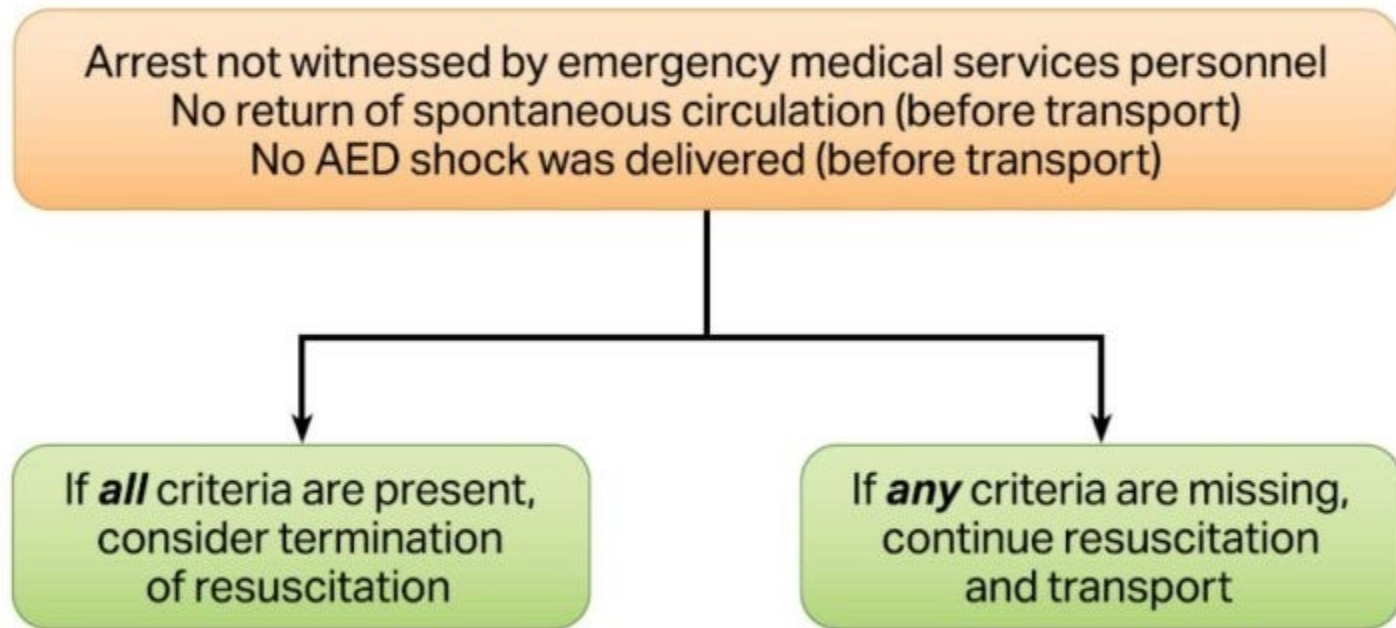
Recommendations for Adjuncts to CPR		
COR	LOE	Recommendations
2b	C-LD	1. If an experienced sonographer is present and use of ultrasound does not interfere with the standard cardiac arrest treatment protocol, then ultrasound may be considered as an adjunct to standard patient evaluation, although its 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.

Termination of resuscitation

Termination of Resuscitation

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.

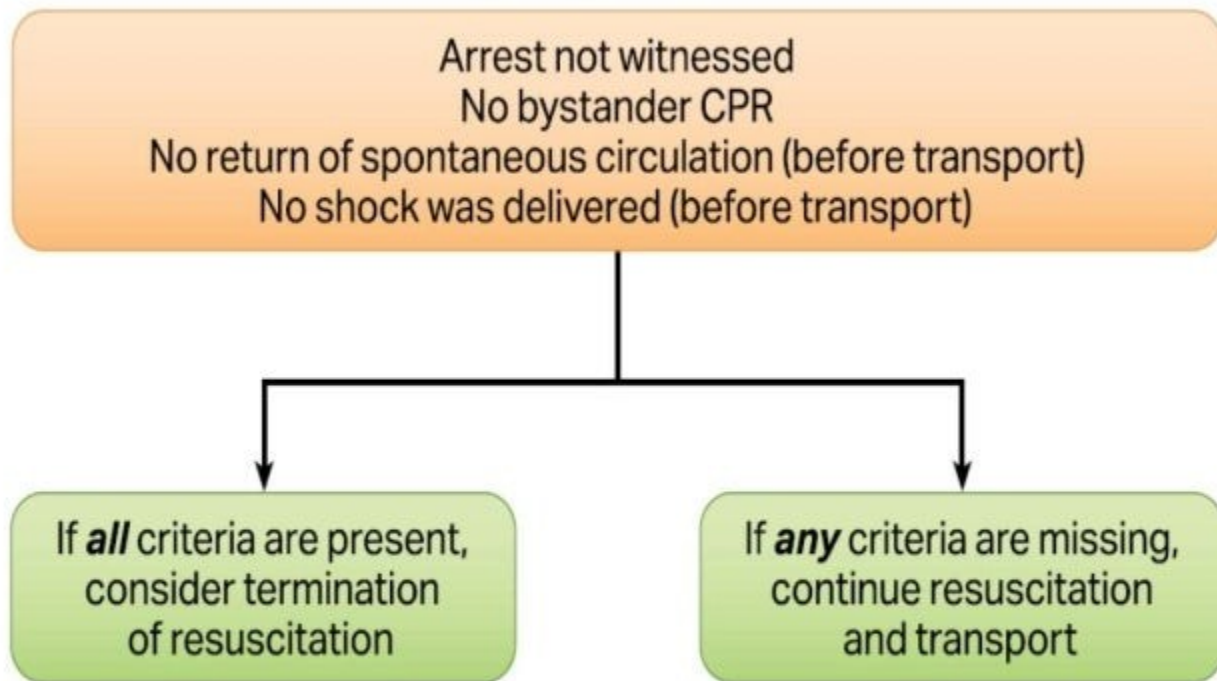
BLS Termination of Resuscitation



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Figure 5. Adult basic life support termination of resuscitation rule.²
AED indicates automated external defibrillator; and BLS, basic life support.

ACLS Termination of Resuscitation



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Figure 6. Adult advanced life support termination of resuscitation rule.²

ACLS indicates advanced cardiovascular life support; and CPR, cardiopulmonary resuscitation.





Arrhythmias



Wide-Complex Tachycardia

Recommendations for Pharmacological Management of Hemodynamically Stable Wide-Complex Tachycardia

COR	LOE	Recommendations
2b	B-NR	1. In hemodynamically stable patients, IV adenosine may be considered for treatment and aiding rhythm diagnosis when the cause of the regular, monomorphic rhythm cannot be determined.
2b	B-R	2. Administration of IV amiodarone, procainamide, or sotalol may be considered for the treatment of wide-complex tachycardia.
3: Harm	B-NR	3. Verapamil should not be administered for any wide-complex tachycardia unless known to be of supraventricular origin and not being conducted by an accessory pathway.
3: Harm	C-LD	4. Adenosine should not be administered for hemodynamically unstable, irregularly irregular, or polymorphic wide-complex tachycardias.

Recommendation for Electric Management of Hemodynamically Stable Wide-Complex Tachycardia

COR	LOE	Recommendation
2a	C-LD	1. If pharmacological therapy is unsuccessful for the treatment of a hemodynamically stable wide-complex tachycardia, cardioversion or seeking urgent expert consultation is reasonable.

Recommendation for Electric Treatment of Polymorphic VT

COR	LOE	Recommendation
1	B-NR	1. Immediate defibrillation is recommended for sustained, hemodynamically unstable polymorphic VT.

Recommendations for Pharmacological Treatment of Polymorphic VT Not Associated With a Long QT Interval

COR	LOE	Recommendations
2b	C-LD	1. IV lidocaine, amiodarone, and measures to treat myocardial ischemia may be considered to treat polymorphic VT in the absence of a prolonged QT interval.
3: No Benefit	C-LD	2. We do not recommend routine use of magnesium for the treatment of polymorphic VT with a normal QT interval.

Recommendations for Electric Therapies for Regular Narrow-Complex Tachycardia

COR	LOE	Recommendations
1	B-NR	1. Synchronized cardioversion is recommended for acute treatment in patients with hemodynamically unstable SVT.
1	B-NR	2. Synchronized cardioversion is recommended for acute treatment in patients with hemodynamically stable SVT when vagal maneuvers and pharmacological therapy is ineffective or contraindicated.

Recommendations for Pharmacological Therapies for Regular Narrow-Complex Tachycardia

COR	LOE	Recommendations
1	B-R	1. Vagal maneuvers are recommended for acute treatment in patients with SVT at a regular rate.
1	B-R	2. Adenosine is recommended for acute treatment in patients with SVT at a regular rate.
2a	B-R	3. IV diltiazem or verapamil can be effective for acute treatment in patients with hemodynamically stable SVT at a regular rate.
2a	C-LD	4. IV β -adrenergic blockers are reasonable for acute treatment in patients with hemodynamically stable SVT at a regular rate.

Recommendations for Electric Therapies for Atrial Fibrillation/ Flutter

COR	LOE	Recommendations
1	C-LD	1. Hemodynamically unstable patients with atrial fibrillation or atrial flutter with rapid ventricular response should receive electric cardioversion.
1	C-LD	2. Urgent direct-current cardioversion of new-onset atrial fibrillation in the setting of acute coronary syndrome is recommended for patients with hemodynamic compromise, ongoing ischemia, or inadequate rate control.
2a	C-LD	3. For synchronized cardioversion of atrial fibrillation using biphasic energy, an initial energy of 120 to 200 J is reasonable, depending on the specific biphasic defibrillator being used.
2b	C-LD	4. For synchronized cardioversion of atrial flutter using biphasic energy, an initial energy of 50 to 100 J may be reasonable, depending on the specific biphasic defibrillator being used.

Recommendations for Medical Therapies for Atrial Fibrillation/ Flutter		
COR	LOE	Recommendations
1	B-NR	1. IV administration of a β -adrenergic blocker or nondihydropyridine calcium channel antagonist is recommended to slow the ventricular heart rate in the acute setting in patients with atrial fibrillation or atrial flutter with rapid ventricular response without preexcitation.
2a	B-NR	2. IV amiodarone can be useful for rate control in critically ill patients with atrial fibrillation with rapid ventricular response without preexcitation.
3: Harm	C-LD	3. In patients with atrial fibrillation and atrial flutter in the setting of preexcitation, digoxin, nondihydropyridine calcium channel antagonists, β -adrenergic blockers, and IV amiodarone should not be administered because they may increase the ventricular response and result in VF.
3: Harm	C-EO	4. Nondihydropyridine calcium channel antagonists and IV β -adrenergic blockers should not be used in patients with left ventricular systolic dysfunction and decompensated heart failure because these may lead to further hemodynamic compromise.

Table 3. IV Medications Commonly Used for Acute Rate Control in Atrial Fibrillation and Atrial Flutter¹⁸

Medication	Bolus Dose	Infusion Rate	Notes
Nondihydropyridine Calcium Channel Blockers			
Diltiazem	0.25 mg/kg IV bolus over 2 min	5–10 mg/h	Avoid in hypotension, heart failure, cardiomyopathy, and acute coronary syndromes
Verapamil	0.075–0.15 mg/kg IV bolus over 2 min; may give an additional dose after 30 min if no response	0.005 mg/kg per min	Avoid in hypotension, heart failure, cardiomyopathy, acute and coronary syndromes
β-Adrenergic Blockers			
Metoprolol	2.5–5 mg over 2 min, up to 3 doses		Avoid in decompensated heart failure
Esmolol	500 µg/kg IV over 1 min	50–300 µg/kg per min	Short duration of action; avoid in decompensated heart failure
Propranolol	1 mg IV over 1 min, up to 3 doses		Avoid in decompensated heart failure
Other Medications			
Amiodarone	300 mg IV over 1 h	10–50 mg/h over 24 h	Multiple dosing schemes exist for amiodarone
Digoxin	0.25 mg IV, repeated to maximum dose 1.5 mg over 24 h		Typically used as adjunctive therapy with another option from above; caution in patients with renal impairment

Recommendations for Initial Management of Bradycardia

COR	LOE	Recommendations
1	C-EO	1. In patients presenting with acute symptomatic bradycardia, evaluation and treatment of reversible causes is recommended.
2a	B-NR	2. In patients with acute bradycardia associated with hemodynamic compromise, administration of atropine is reasonable to increase heart rate.
2b	C-LD	3. If bradycardia is unresponsive to atropine, IV adrenergic agonists with rate-accelerating effects (eg, epinephrine) or transcutaneous pacing may be effective while the patient is prepared for emergent transvenous temporary pacing if required.
2b	C-EO	4. Immediate pacing might be considered in unstable patients with high-degree AV block when IV/IO access is not available.





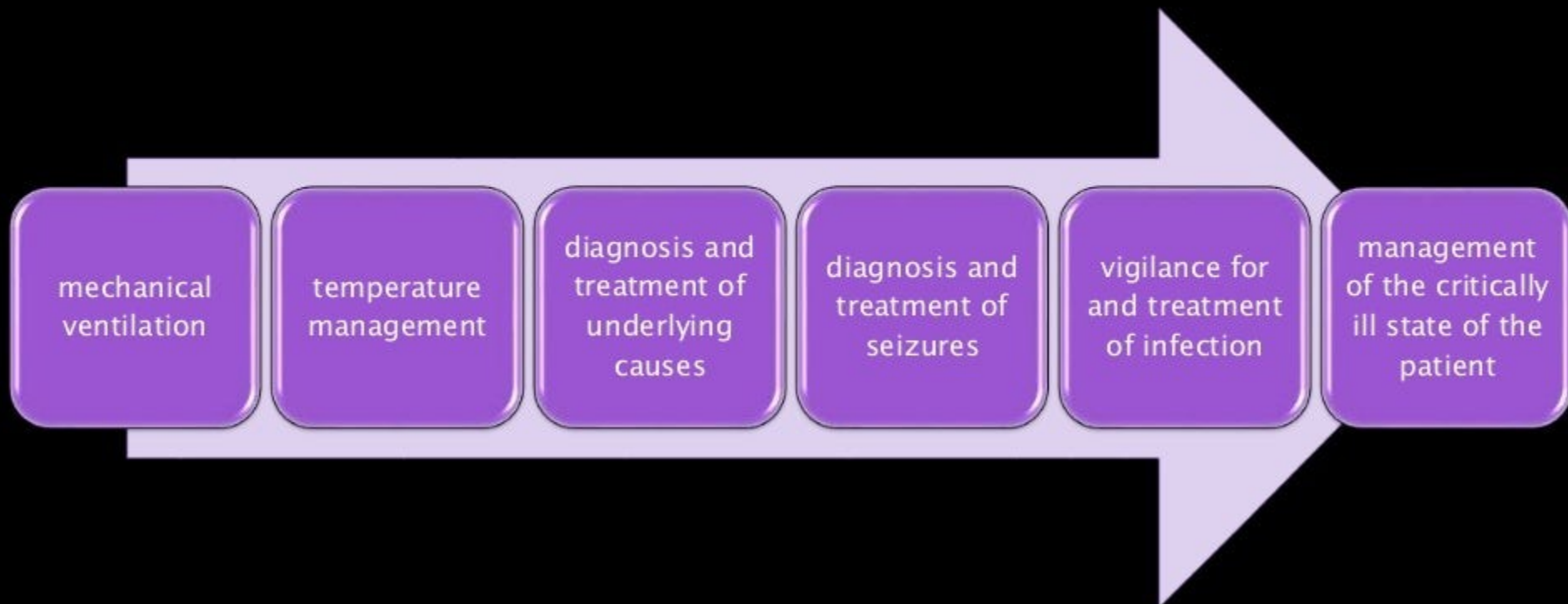
Post resuscitation
Care



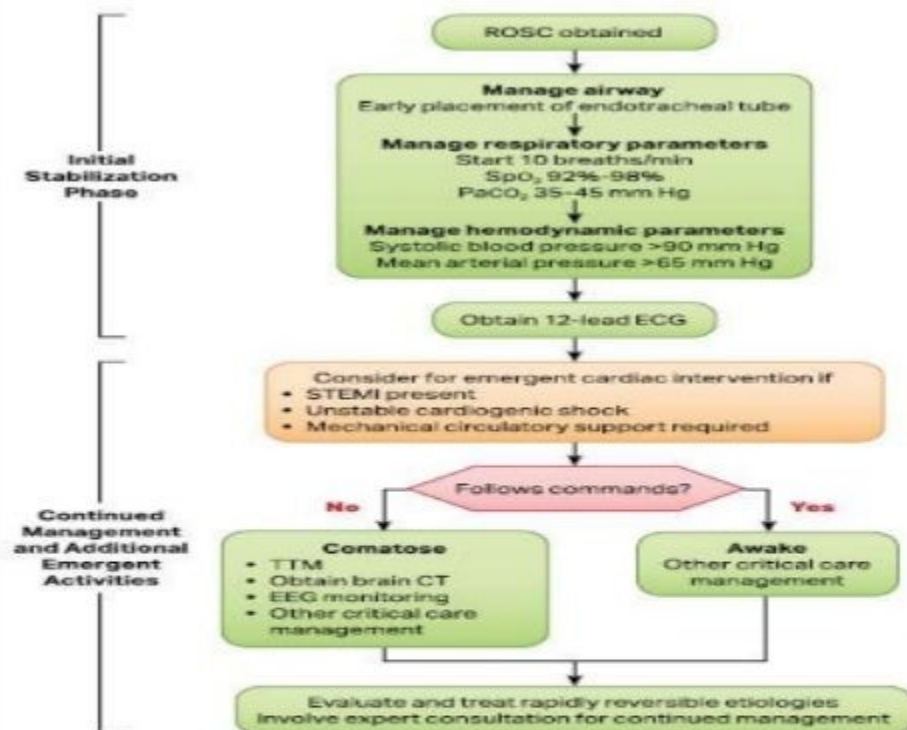
ROSC

Post-cardiac
arrest care is
a critical
component of
the Chain of
Survival.

care of critically ill post arrest patients hinges on hemodynamic support



Adult Post-Cardiac Arrest Care Algorithm



Initial Stabilization Phase

Resuscitation is ongoing during the post-ROSC phase, and many of these activities can occur concurrently. However, if prioritization is necessary, follow these steps:

- **Airway management:** Waveform capnography or capnometry to confirm and monitor endotracheal tube placement
- **Manage respiratory parameters:** Titrate FiO_2 for SpO_2 92%-98%; start at 10 breaths/min; titrate to PaCO_2 of 35-45 mm Hg
- **Manage hemodynamic parameters:** Administer crystalloid and/or vasopressor or inotrope for goal systolic blood pressure >90 mm Hg or mean arterial pressure >65 mm Hg

Continued Management and Additional Emergent Activities

These evaluations should be done concurrently so that decisions on targeted temperature management (TTM) receive high priority as cardiac interventions.

- **Emergent cardiac intervention:** Early evaluation of 12-lead electrocardiogram (ECG); consider hemodynamics for decision on cardiac intervention
- **TTM:** if patient is not following commands, start TTM as soon as possible; begin at 32-36°C for 24 hours by using a cooling device with feedback loop
- **Other critical care management**
 - Continuously monitor core temperature (esophageal, rectal, bladder)
 - Maintain normoxia, normocapnia, euglycemia
 - Provide continuous or intermittent electroencephalogram (EEG) monitoring
 - Provide lung-protective ventilation

H's and T's

Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypokalemia/hyperkalemia
Hypothermia
Tension pneumothorax
Tamponade, cardiac
Toxins
Thrombosis, pulmonary
Thrombosis, coronary

Recommendations for Considerations in the Early Postresuscitation Period		
COR	LOE	Recommendations
1	B-NR	1. A comprehensive, structured, multidisciplinary system of care should be implemented in a consistent manner for the treatment of post-cardiac arrest patients.
1	B-NR	2. A 12-lead ECG should be obtained as soon as feasible after ROSC to determine whether acute ST-segment elevation is present.
2a	C-EO	3. To avoid hypoxia in adults with ROSC in the immediate postarrest period, it is reasonable to use the highest available oxygen concentration until the arterial oxyhemoglobin saturation or the partial pressure of arterial oxygen can be measured reliably.

Recommendation for Blood Pressure Management After ROSC		
COR	LOE	Recommendation
2a	B-NR	1. It is preferable to avoid hypotension by maintaining a systolic blood pressure of at least 90 mmHg and a mean arterial pressure of at least 65 mmHg in the postresuscitation period.

Recommendations for Oxygenation and Ventilation After ROSC

COR	LOE	Recommendations
1	B-NR	1. We recommend avoiding hypoxemia in all patients who remain comatose after ROSC.
2b	B-R	2. Once reliable measurement of peripheral blood oxygen saturation is available, avoiding hyperoxemia by titrating the fraction of inspired oxygen to target an oxygen saturation of 92% to 98% may be reasonable in patients who remain comatose after ROSC.
2b	B-R	3. Maintaining the arterial partial pressure of carbon dioxide (P_{aCO_2}) within a normal physiological range (generally 35–45 mm Hg) may be reasonable in patients who remain comatose after ROSC.

Recommendations for Other Postresuscitation Care

COR	LOE	Recommendations
2b	B-R	1. The benefit of any specific target range of glucose management is uncertain in adults with ROSC after cardiac arrest.
2b	B-R	2. The routine use of prophylactic antibiotics in postarrest patients is of uncertain benefit.
2b	B-R	3. The effectiveness of agents to mitigate neurological injury in patients who remain comatose after ROSC is uncertain.
2b	B-R	4. The routine use of steroids for patients with shock after ROSC is of uncertain value.

Recommendations for Seizure Diagnosis and Management

COR	LOE	Recommendations
1	C-LD	1. We recommend treatment of clinically apparent seizures in adult post-cardiac arrest survivors.
1	C-LD	2. We recommend promptly performing and interpreting an electroencephalogram (EEG) for the diagnosis of seizures in all comatose patients after ROSC.
2b	C-LD	3. The treatment of nonconvulsive seizures (diagnosed by EEG only) may be considered.
2b	C-LD	4. The same anticonvulsant regimens used for the treatment of seizures caused by other etiologies may be considered for seizures detected after cardiac arrest.
3: No Benefit	B-R	5. Seizure prophylaxis in adult post-cardiac arrest survivors is not recommended.

Recommendations for Indications for TTM

COR	LOE	Recommendations
1	B-R	1. We recommend TTM for adults who do not follow commands after ROSC from OHCA with any initial rhythm.
1	B-R	2. We recommend TTM for adults who do not follow commands after ROSC from IHCA with initial nonshockable rhythm.
1	B-NR	3. We recommend TTM for adults who do not follow commands after ROSC from IHCA with initial shockable rhythm.

Recommendations for Performance of TTM

COR	LOE	Recommendations
1	B-R	1. We recommend selecting and maintaining a constant temperature between 32°C and 36°C during TTM.
2a	B-NR	2. It is reasonable that TTM be maintained for at least 24 h after achieving target temperature.
2b	C-LD	3. It may be reasonable to actively prevent fever in comatose patients after TTM.
3: No Benefit	A	4. We do not recommend the routine use of rapid infusion of cold IV fluids for prehospital cooling of patients after ROSC.

PCI After Cardiac Arrest

Recommendations for PCI After Cardiac Arrest		
COR	LOE	Recommendations
1	B-NR	1. Coronary angiography should be performed emergently for all cardiac arrest patients with suspected cardiac cause of arrest and ST-segment elevation on ECG.
2a	B-NR	2. Emergent coronary angiography is reasonable for select (eg, electrically or hemodynamically unstable) adult patients who are comatose after OHCA of suspected cardiac origin but without ST-segment elevation on ECG.
2a	C-LD	3. Independent of a patient's mental status, coronary angiography is reasonable in all post-cardiac arrest patients for whom coronary angiography is otherwise indicated.

Recommendations for General Considerations for Neuroprognostication

COR	LOE	Recommendations
1	B-NR	1. In patients who remain comatose after cardiac arrest, we recommend that neuroprognostication involve a multimodal approach and not be based on any single finding.
1	B-NR	2. In patients who remain comatose after cardiac arrest, we recommend that neuroprognostication be delayed until adequate time has passed to ensure avoidance of confounding by medication effect or a transiently poor examination in the early postinjury period.
1	C-EO	3. We recommend that teams caring for comatose cardiac arrest survivors have regular and transparent multidisciplinary discussions with surrogates about the anticipated time course for and uncertainties around neuroprognostication.
2a	B-NR	4. In patients who remain comatose after cardiac arrest, it is reasonable to perform multimodal neuroprognostication at a minimum of 72 h after normothermia, though individual prognostic tests may be obtained earlier than this.

Neuroprognostication

Recommendations for Clinical Examination for Neuroprognostication		
COR	LOE	Recommendations
2b	B-NR	1. When performed with other prognostic tests, it may be reasonable to consider bilaterally absent pupillary light reflex at 72 h or more after cardiac arrest to support the prognosis of poor neurological outcome in patients who remain comatose.
2b	B-NR	2. When performed with other prognostic tests, it may be reasonable to consider quantitative pupillometry at 72 h or more after cardiac arrest to support the prognosis of poor neurological outcome in patients who remain comatose.
2b	B-NR	3. When performed with other prognostic tests, it may be reasonable to consider bilaterally absent corneal reflexes at 72 h or more after cardiac arrest to support the prognosis of poor neurological outcome in patients who remain comatose.
2b	B-NR	4. When performed with other prognostic tests, it may be reasonable to consider status myoclonus that occurs within 72 h after cardiac arrest to support the prognosis of poor neurological outcome.
2b	B-NR	5. We suggest recording EEG in the presence of myoclonus to determine if there is an associated cerebral correlate.
3: Harm	B-NR	6. The presence of undifferentiated myoclonic movements after cardiac arrest should not be used to support a poor neurological prognosis.
3: Harm	B-NR	7. We recommend that the findings of a best motor response in the upper extremities being either absent or extensor movements not be used alone for predicting a poor neurological outcome in patients who remain comatose after cardiac arrest.

Use of Serum Biomarkers for Neuroprognostication

Recommendations for Serum Biomarkers for Neuroprognostication		
COR	LOE	Recommendations
2b	B-NR	1. When performed in combination with other prognostic tests, it may be reasonable to consider high serum values of neuron-specific enolase (NSE) within 72 h after cardiac arrest to support the prognosis of poor neurological outcome in patients who remain comatose.
2b	C-LD	2. The usefulness of S100 calcium-binding protein (S100B), Tau, neurofilament light chain, and glial fibrillary acidic protein in neuroprognostication is uncertain.

Use of Electrophysiological Tests for Neuroprognostication

Recommendations for Electrophysiology for Neuroprognostication		
COR	LOE	Recommendations
2b	B-NR	1. When evaluated with other prognostic tests, the prognostic value of seizures in patients who remain comatose after cardiac arrest is uncertain.
2b	B-NR	2. When performed with other prognostic tests, it may be reasonable to consider persistent status epilepticus 72 h or more after cardiac arrest to support the prognosis of poor neurological outcome.
2b	B-NR	3. When performed with other prognostic tests, it may be reasonable to consider burst suppression on EEG in the absence of sedating medications at 72 h or more after arrest to support the prognosis of poor neurological outcome.
2b	B-NR	4. When performed with other prognostic tests, it may be reasonable to consider bilaterally absent N20 somatosensory evoked potential (SSEP) waves more than 24 h after cardiac arrest to support the prognosis of poor neurological outcome.
2b	B-NR	5. When evaluated with other prognostic tests after arrest, the usefulness of rhythmic periodic discharges to support the prognosis of poor neurological outcome is uncertain.
3: No Benefit	B-NR	6. We recommend that the absence of EEG reactivity within 72 h after arrest not be used alone to support a poor neurological prognosis.

Use of Neuroimaging for Neuroprognostication

Recommendations for Neuroimaging for Neuroprognostication

COR	LOE	Recommendations
2b	B-NR	1. When performed with other prognostic tests, it may be reasonable to consider reduced gray-white ratio (GWR) on brain computed tomography (CT) after cardiac arrest to support the prognosis of poor neurological outcome in patients who remain comatose.
2b	B-NR	2. When performed with other prognostic tests, it may be reasonable to consider extensive areas of restricted diffusion on brain MRI (MRI) at 2 to 7 days after cardiac arrest to support the prognosis of poor neurological outcome in patients who remain comatose.
2b	B-NR	3. When performed with other prognostic tests, it may be reasonable to consider extensive areas of reduced apparent diffusion coefficient (ADC) on brain MRI at 2 to 7 days after cardiac arrest to support the prognosis of poor neurological outcome in patients who remain comatose.

RECOVERY

Recovery and Survivorship After Cardiac Arrest

Recommendations for Recovery and Survivorship After Cardiac Arrest		
COR	LOE	Recommendations
1	B-NR	1. We recommend structured assessment for anxiety, depression, posttraumatic stress, and fatigue for cardiac arrest survivors and their caregivers.
1	C-LD	2. We recommend that cardiac arrest survivors have multimodal rehabilitation assessment and treatment for physical, neurological, cardiopulmonary, and cognitive impairments before discharge from the hospital.
1	C-LD	3. We recommend that cardiac arrest survivors and their caregivers receive comprehensive, multidisciplinary discharge planning, to include medical and rehabilitative treatment recommendations and return to activity/work expectations.
2b	C-LD	4. Debriefings and referral for follow-up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after a cardiac arrest event may be beneficial.



Ultra-Short Term

Expectations

- Early physical recovery, identification of underlying cause, potential recognition of cognitive challenges, highest risk for anxiety/PTSD
- Monitoring for seizures and medication side effects
- Reassessment of swallowing

Action Plan

- Work with PT/OT/SLP/ rehabilitation to recover strength/function
- Discuss cognitive/behavioral changes with PT/OT/SLP and family
- Seek strategies, psychology/neuropsychology referral, and medication management/



Short Term

Expectations

- Improvement in cognitive function
- Ongoing improvement in activities of daily living and cardiovascular resilience

Action Plan

- Continue strategies and behavioral activations
- Increase cardiovascular exercise



Medium Term

Expectations

- Improvement in memory
- Return to work or baseline activities

Action Plan

- Continue strategies
- Consider involvement in support group, prevention of recurrent arrest, and family member evaluation



Long Term

Expectations

- Often improvement in anxiety, depression, PTSD, and quality of life
- Fatigue and cognitive impairments may be persistent

Action Plan

- Continue strategies
- Prevent recurrent arrest
- Evaluate family members





cardiac
arrest
in Special
circumstances



Accidental Hypothermia

Recommendations for Accidental Hypothermia		
COR	LOE	Recommendations
1	C-LD	1. Full resuscitative measures, including extracorporeal rewarming when available, are recommended for all victims of accidental hypothermia without characteristics that deem them unlikely to survive and without any obviously lethal traumatic injury.
1	C-EO	2. Victims of accidental hypothermia should not be considered dead before rewarming has been provided unless there are signs of obvious death.
2b	C-LD	3. It may be reasonable to perform defibrillation attempts according to the standard BLS algorithm concurrent with rewarming strategies.
2b	C-LD	4. It may be reasonable to consider administration of epinephrine during cardiac arrest according to the standard ACLS algorithm concurrent with rewarming strategies.

Recommendation for Cardiac Arrest From Anaphylaxis

COR	LOE	Recommendation
1	C-LD	1. In cardiac arrest secondary to anaphylaxis, standard resuscitative measures and immediate administration of epinephrine should take priority.

Recommendations for Anaphylaxis Without Cardiac Arrest		
COR	LOE	Recommendations
1	C-LD	1. Epinephrine should be administered early by intramuscular injection (or autoinjector) to all patients with signs of a systemic allergic reaction, especially hypotension, airway swelling, or difficulty breathing.
1	C-LD	2. The recommended dose of epinephrine in anaphylaxis is 0.2 to 0.5 mg (1:1000) intramuscularly, to be repeated every 5 to 15 min as needed.
1	C-LD	3. In patients with anaphylactic shock, close hemodynamic monitoring is recommended.
1	C-LD	4. Given the potential for the rapid development of oropharyngeal or laryngeal edema, immediate referral to a health professional with expertise in advanced airway placement, including surgical airway management, is recommended.
2a	C-LD	5. When an IV line is in place, it is reasonable to consider the IV route for epinephrine in anaphylactic shock, at a dose of 0.05 to 0.1 mg (0.1 mg/mL, aka 1:10 000).
2a	C-LD	6. IV infusion of epinephrine is a reasonable alternative to IV boluses for treatment of anaphylaxis in patients not in cardiac arrest.
2b	C-LD	7. IV infusion of epinephrine may be considered for postarrest shock in patients with anaphylaxis.

Cardiac Arrest Due to Asthma

Recommendations for Management of Cardiac Arrest Due to Asthma

COR	LOE	Recommendations
1	C-LD	1. For asthmatic patients with cardiac arrest, sudden elevation in peak inspiratory pressures or difficulty ventilating should prompt evaluation for tension pneumothorax.
2a	C-LD	2. Due to the potential effects of intrinsic positive end-expiratory pressure (auto-PEEP) and risk of barotrauma in an asthmatic patient with cardiac arrest, a ventilation strategy of low respiratory rate and tidal volume is reasonable.
2a	C-LD	3. If increased auto-PEEP or sudden decrease in blood pressure is noted in asthmatics receiving assisted ventilation in a periarrest state, a brief disconnection from the bag mask or ventilator with compression of the chest wall to relieve air-trapping can be effective.

Cardiac Arrest After Cardiac Surgery

Recommendations for Cardiac Arrest After Cardiac Surgery

COR	LOE	Recommendations
1	B-NR	1. External chest compressions should be performed if emergency re sternotomy is not immediately available.
1	C-LD	2. In a trained provider-witnessed arrest of a post-cardiac surgery patient, immediate defibrillation for VF/VT should be performed. CPR should be initiated if defibrillation is not successful within 1 min.
1	C-EO	3. In a trained provider-witnessed arrest of a post-cardiac surgery patient where pacer wires are already in place, we recommend immediate pacing in an asystolic or bradycardic arrest. CPR should be initiated if pacing is not successful within 1 min.
2a	B-NR	4. For patients with cardiac arrest after cardiac surgery, it is reasonable to perform re sternotomy early in an appropriately staffed and equipped ICU.
2a	C-LD	5. Open-chest CPR can be useful if cardiac arrest develops during surgery when the chest or abdomen is already open, or in the early postoperative period after cardiothoracic surgery.
2b	C-LD	6. In post-cardiac surgery patients who are refractory to standard resuscitation procedures, mechanical circulatory support may be effective in improving outcome.

Drowning

Recommendations for Drowning

COR	LOE	Recommendations
1	C-LD	1. Rescuers should provide CPR, including rescue breathing, as soon as an unresponsive submersion victim is removed from the water.
1	C-LD	2. All victims of drowning who require any form of resuscitation (including rescue breathing alone) should be transported to the hospital for evaluation and monitoring, even if they appear to be alert and demonstrate effective cardiorespiratory function at the scene.
2b	C-LD	3. Mouth-to-mouth ventilation in the water may be helpful when administered by a trained rescuer if it does not compromise safety.
3: No Benefit	B-NR	4. Routine stabilization of the cervical spine in the absence of circumstances that suggest a spinal injury is not recommended.

Electrolyte Abnormalities

Recommendations for Electrolyte Abnormalities in Cardiac Arrest

COR	LOE	Recommendations
1	C-LD	1. For cardiac arrest with known or suspected hyperkalemia, in addition to standard ACLS care, IV calcium should be administered.
1	C-LD	2. For cardiotoxicity and cardiac arrest from severe hypomagnesemia, in addition to standard ACLS care, IV magnesium is recommended.
2b	C-EO	3. For cardiac arrest with known or suspected hypermagnesemia, in addition to standard ACLS care, it may be reasonable to administer empirical IV calcium.
3: Harm	C-LD	4. IV bolus administration of potassium for cardiac arrest in suspected hypokalemia is not recommended.

Pulmonary Embolism

Recommendations for Pulmonary Embolism

COR	LOE	Recommendations
2a	C-LD	1. In patients with confirmed pulmonary embolism as the precipitant of cardiac arrest, thrombolysis, surgical embolectomy, and mechanical embolectomy are reasonable emergency treatment options.
2b	C-LD	2. Thrombolysis may be considered when cardiac arrest is suspected to be caused by pulmonary embolism.





Cardiac arrest
in pregnancy



2020 (New): Because pregnant patients are more prone to hypoxia, oxygenation and airway management should be prioritized during resuscitation from cardiac arrest in pregnancy.

2020 (New): Because of potential interference with maternal resuscitation, fetal monitoring should not be undertaken during cardiac arrest in pregnancy.

2020 (New): We recommend targeted temperature management for pregnant women who remain comatose after resuscitation from cardiac arrest.

2020 (New): During targeted temperature management of the pregnant patient, it is recommended that the fetus be continuously monitored for bradycardia as a potential complication, and obstetric and neonatal consultation should be sought.

Recommendations for Planning and Preparation for Cardiac Arrest in Pregnancy

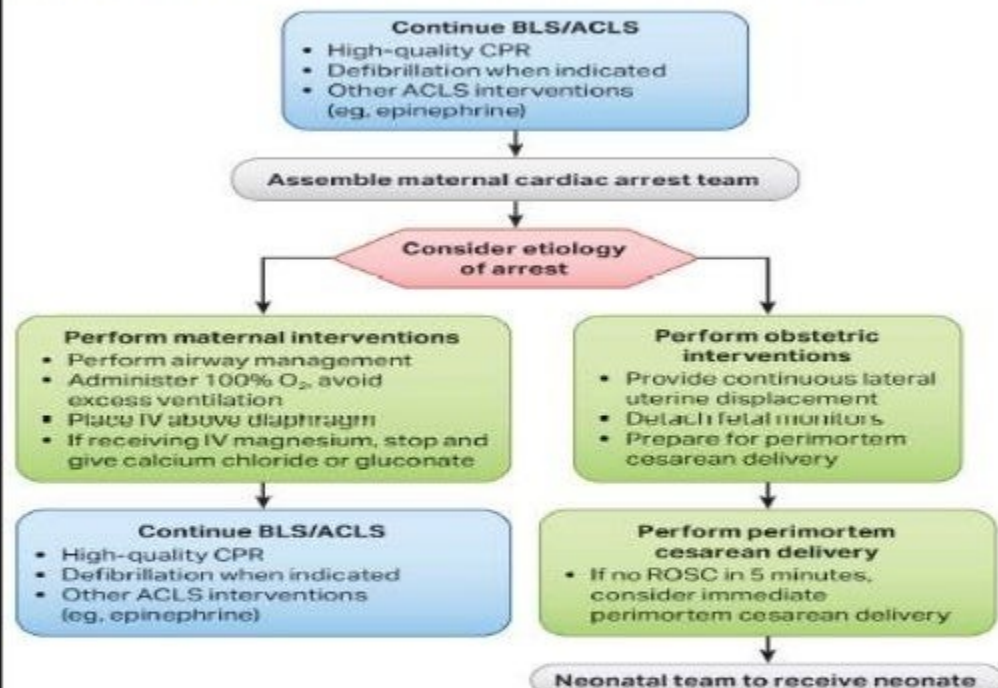
COR	LOE	Recommendations
1	C-LD	1. Team planning for cardiac arrest in pregnancy should be done in collaboration with the obstetric, neonatal, emergency, anesthesiology, intensive care, and cardiac arrest services.
1	C-LD	2. Because immediate ROSC cannot always be achieved, local resources for a perimortem cesarean delivery should be summoned as soon as cardiac arrest in a woman in the second half of pregnancy is recognized.
1	C-EO	3. Protocols for management of OHCA in pregnancy should be developed to facilitate timely transport to a center with capacity to immediately perform perimortem cesarean delivery while providing ongoing resuscitation.

Recommendations for Resuscitation of Cardiac Arrest in Pregnancy		
COR	LOE	Recommendations
1	C-LD	1. Priorities for the pregnant woman in cardiac arrest should include provision of high-quality CPR and relief of aortocaval compression through left lateral uterine displacement.
1	C-LD	2. Because pregnant patients are more prone to hypoxia, oxygenation and airway management should be prioritized during resuscitation from cardiac arrest in pregnancy.
1	C-EO	3. Because of potential interference with maternal resuscitation, fetal monitoring should not be undertaken during cardiac arrest in pregnancy.
1	C-EO	4. We recommend targeted temperature management for pregnant women who remain comatose after resuscitation from cardiac arrest.
1	C-EO	5. During targeted temperature management of the pregnant patient, it is recommended that the fetus be continuously monitored for bradycardia as a potential complication, and obstetric and neonatal consultation should be sought.

Recommendations for Cardiac Arrest and PMCD

COR	LOE	Recommendations
1	C-LD	1. During cardiac arrest, if the pregnant woman with a fundus height at or above the umbilicus has not achieved ROSC with usual resuscitation measures plus manual left lateral uterine displacement, it is advisable to prepare to evacuate the uterus while resuscitation continues.
1	C-LD	2. In situations such as nonsurvivable maternal trauma or prolonged pulselessness, in which maternal resuscitative efforts are considered futile, there is no reason to delay performing perimortem cesarean delivery in appropriate patients.
2a	C-EO	3. To accomplish delivery early, ideally within 5 min after the time of arrest, it is reasonable to immediately prepare for perimortem cesarean delivery while initial BLS and ACLS interventions are being performed.

Figure 9. Cardiac Arrest in Pregnancy In-Hospital ACLS Algorithm.



Maternal Cardiac Arrest

- Team planning should be done in collaboration with the obstetric, neonatal, emergency, anesthesiology, intensive care, and cardiac arrest services.
- Priorities for pregnant women in cardiac arrest should include provision of high-quality CPR and relief of aortocaval compression with lateral uterine displacement.
- The goal of perimortem cesarean delivery is to improve maternal and fetal outcomes.
- Ideally, perform perimortem cesarean delivery in 5 minutes, depending on provider resources and skill sets.

Advanced Airway

- In pregnancy, a difficult airway is common. Use the most experienced provider.
- Provide endotracheal intubation or supraglottic advanced airway.
- Perform waveform capnography or capnometry to confirm and monitor ET tube placement.
- Once advanced airway is in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions.

Potential Etiology of Maternal Cardiac Arrest

- A** Anesthetic complications
- B** Bleeding
- C** Cardiovascular
- D** Drugs
- E** Embolic
- F** Fever
- G** General nonobstetric causes of cardiac arrest (H's and T's)
- H** Hypertension





Cardiac arrest in
toxicological cases



Recommendations for Acute Management of Opioid Overdose

COR	LOE	Recommendations
1	C-LD	1. For patients in respiratory arrest, rescue breathing or bag-mask ventilation should be maintained until spontaneous breathing returns, and standard BLS and/or ACLS measures should continue if return of spontaneous breathing does not occur.
1	C-EO	2. For patients known or suspected to be in cardiac arrest, in the absence of a proven benefit from the use of naloxone, standard resuscitative measures should take priority over naloxone administration, with a focus on high-quality CPR (compressions plus ventilation).
1	C-EO	3. Lay and trained responders should not delay activating emergency response systems while awaiting the patient's response to naloxone or other interventions.
2a	B-NR	4. For a patient with suspected opioid overdose who has a definite pulse but no normal breathing or only gasping (ie, a respiratory arrest), in addition to providing standard BLS and/or ACLS care, it is reasonable for responders to administer naloxone.

Recommendations for Postresuscitation Management of Opioid Overdose

COR	LOE	Recommendations
1	C-LD	1. After return of spontaneous breathing, patients should be observed in a healthcare setting until the risk of recurrent opioid toxicity is low and the patient's level of consciousness and vital signs have normalized.
2a	C-LD	2. If recurrent opioid toxicity develops, repeated small doses or an infusion of naloxone can be beneficial.

Toxicity: Benzodiazepines

Recommendation for Benzodiazepine Overdose

COR	LOE	Recommendation
3: Harm	B-R	1. The administration of flumazenil to patients with undifferentiated coma confers risk and is not recommended.

Recommendations for β -Adrenergic Blocker Overdose

COR

LOE

Recommendations

2a

C-LD

1. In patients with β -adrenergic blocker overdose who are in refractory shock, administration of high-dose insulin with glucose is reasonable.

2a

C-LD

2. In patients with β -adrenergic blocker overdose who are in refractory shock, administration of IV glucagon is reasonable.

2b

C-LD

3. In patients with β -adrenergic blocker overdose who are in refractory shock, administration of calcium may be considered.

2b

C-LD

4. In patients with β -adrenergic blocker overdose who are in shock refractory to pharmacological therapy, ECMO might be considered.

Recommendations for Calcium Channel Blocker Overdose

COR	LOE	Recommendations
2a	C-LD	1. In patients with calcium channel blocker overdose who are in refractory shock, administration of calcium is reasonable.
2a	C-LD	2. In patients with calcium channel blocker overdose who are in refractory shock, administration of high-dose insulin with glucose is reasonable.
2b	C-LD	3. In patients with calcium channel blocker overdose who are in refractory shock, administration of IV glucagon may be considered.
2b	C-LD	4. In patients with calcium channel blocker overdose who are in shock refractory to pharmacological therapy, ECMO might be considered.

Toxicity: Cocaine

Recommendations for Cocaine Toxicity

COR	LOE	Recommendations
2a	B-NR	1. For patients with cocaine-induced hypertension, tachycardia, agitation, or chest discomfort, benzodiazepines, alpha blockers, calcium channel blockers, nitroglycerin, and/or morphine can be beneficial.
2b	C-LD	2. Although contradictory evidence exists, it may be reasonable to avoid the use of pure β -adrenergic blocker medications in the setting of cocaine toxicity.

Toxicity: Local Anesthetics

Recommendation for Local Anesthetic Overdose

COR	LOE	Recommendation
2b	C-LD	1. It may be reasonable to administer IV lipid emulsion, concomitant with standard resuscitative care, to patients with local anesthetic systemic toxicity (LAST), and particularly to patients who have premonitory neurotoxicity or cardiac arrest due to bupivacaine toxicity.

Toxicity: Sodium Channel Blockers, Including Tricyclic Antidepressants

Recommendations for Cardiac Arrest Due to Sodium Channel Blockers, Including Tricyclic Antidepressants

COR	LOE	Recommendation
2a	C-LD	1. Administration of sodium bicarbonate for cardiac arrest or life-threatening cardiac conduction delays (ie, QRS prolongation more than 120 ms) due to sodium channel blocker/tricyclic antidepressant (TCA) overdose can be beneficial.
2b	C-LD	2. The use of ECMO for cardiac arrest or refractory shock due to sodium channel blocker/TCA toxicity may be considered.

Toxicity: Carbon Monoxide, Digoxin, and Cyanide

Recommendations for Carbon Monoxide, Digoxin, and Cyanide Poisoning

COR	LOE	Recommendations
1	B-R	1. Antidigoxin Fab antibodies should be administered to patients with severe cardiac glycoside toxicity.
2b	B-R	2. Hyperbaric oxygen therapy may be helpful in the treatment of acute carbon monoxide poisoning in patients with severe toxicity.
2a	C-LD	3. Hydroxocobalamin and 100% oxygen, with or without sodium thiosulfate, can be beneficial for cyanide poisoning.





HOME
MESSAGES



1. On recognition of a cardiac arrest event, a layperson should simultaneously and promptly activate the emergency response system and initiate cardiopulmonary resuscitation (CPR).

2. Performance of high-quality CPR includes adequate compression depth and rate while minimizing pauses in compressions,

3. Early defibrillation with concurrent high-quality CPR is critical to survival when sudden cardiac arrest is caused by ventricular fibrillation or pulseless ventricular tachycardia.

4. Administration of epinephrine with concurrent high-quality CPR improves survival, particularly in patients with nonshockable rhythms.

5. Recognition that all cardiac arrest events are not identical is critical for optimal patient outcome, and specialized management is necessary for many conditions (eg, electrolyte abnormalities, pregnancy, after cardiac surgery).

6. The opioid epidemic has resulted in an increase in opioid-associated out-of-hospital cardiac arrest, with the mainstay of care remaining the activation of the emergency response systems and performance of high-quality CPR.

7. Post-cardiac arrest care is a critical component of the Chain of Survival and demands a comprehensive, structured, multidisciplinary system that requires consistent implementation for optimal patient outcomes.

8. Prompt initiation of targeted temperature management is necessary for all patients who do not follow commands after return of spontaneous circulation to ensure optimal functional and neurological outcome.

9. Accurate neurological prognostication in brain-injured cardiac arrest survivors is critically important to ensure that patients with significant potential for recovery are not destined for certain poor outcomes due to care withdrawal.

10. Recovery expectations and survivorship plans that address treatment, surveillance, and rehabilitation need to be provided to cardiac arrest survivors and their caregivers at hospital discharge to optimize transitions of care to home and to the outpatient setting.

