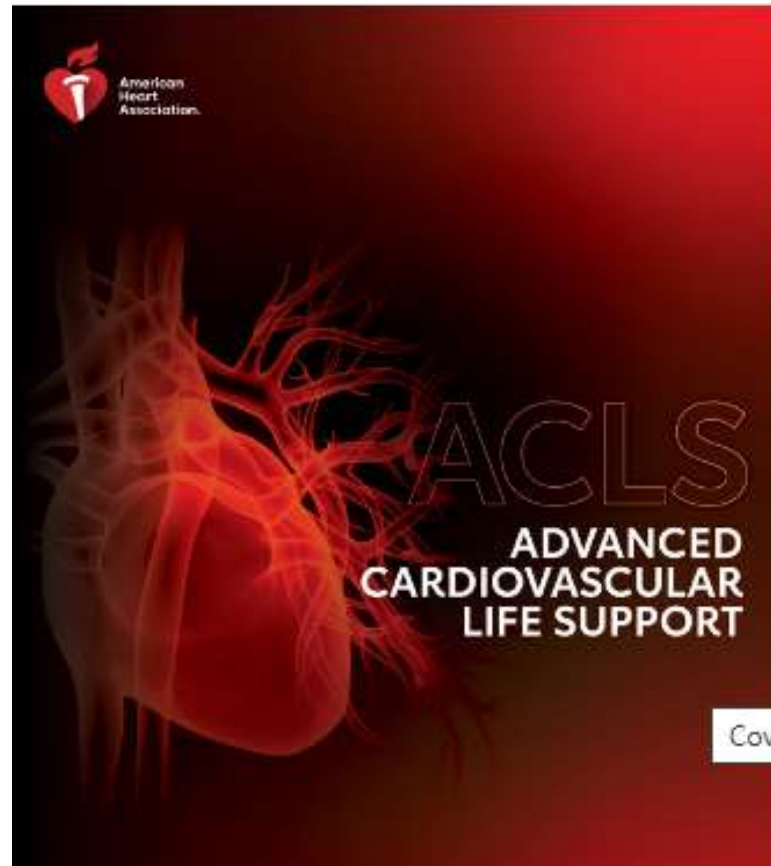


Topics in ACLS



Dr. Ihab Alasasfeh

Resuscitation and global emergency medicine

Overview

- [Systematic Approach](#)
- [Bradycardia](#)
- [Tachycardia](#)
- [Cardiac Arrest](#)

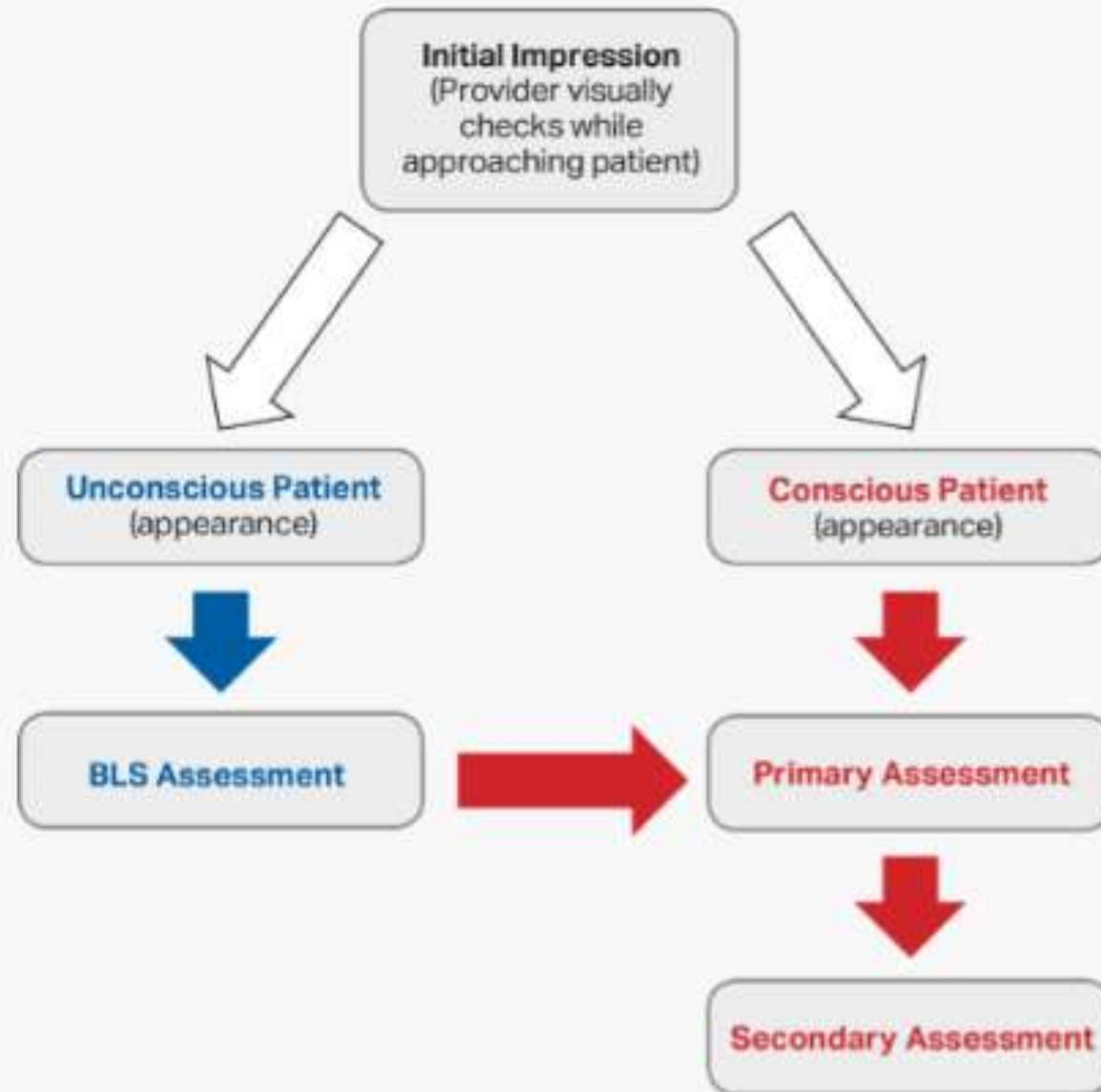
Systematic Approach

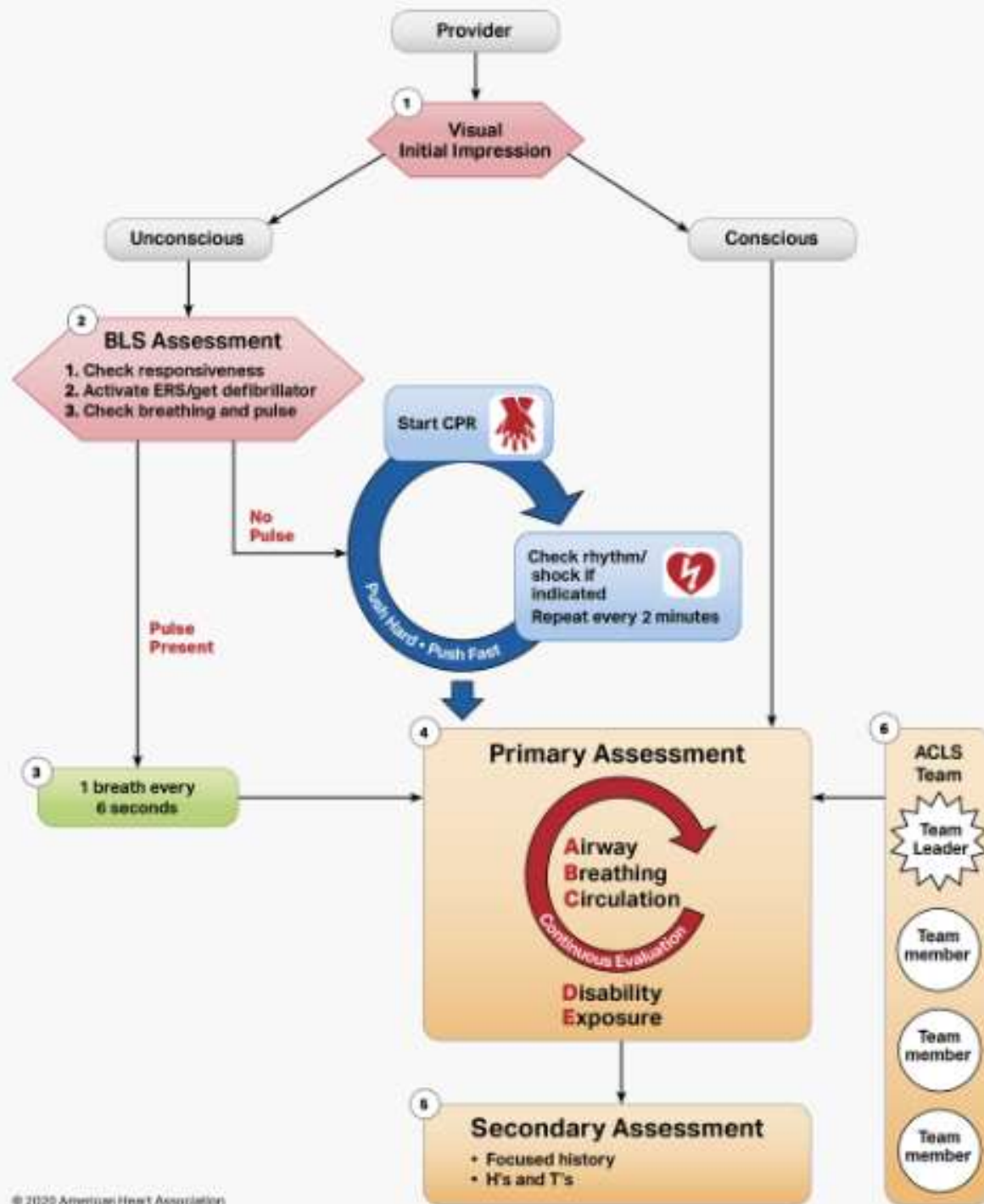
- **Initial assessment** (visualization and scene safety)
- **BLS Assessment**
- **Primary Assessment** (A, B, C, D, and E)
- **Secondary Assessment** (SAMPLE, H's and T's)

Systematic Approach

- **Initial assessment**
- Before you approach any patient, rapidly verify scene safety
- (no threat to the provider).

The Systematic Approach





BLS assessment

- **Early CPR with basic airway management and defibrillation**
- No advanced airway techniques or drug administration
- **Remember to assess first, and then perform the appropriate action.**

BLS assessment

- Check responsiveness
- Tap and shout “Are you OK?”



BLS assessment

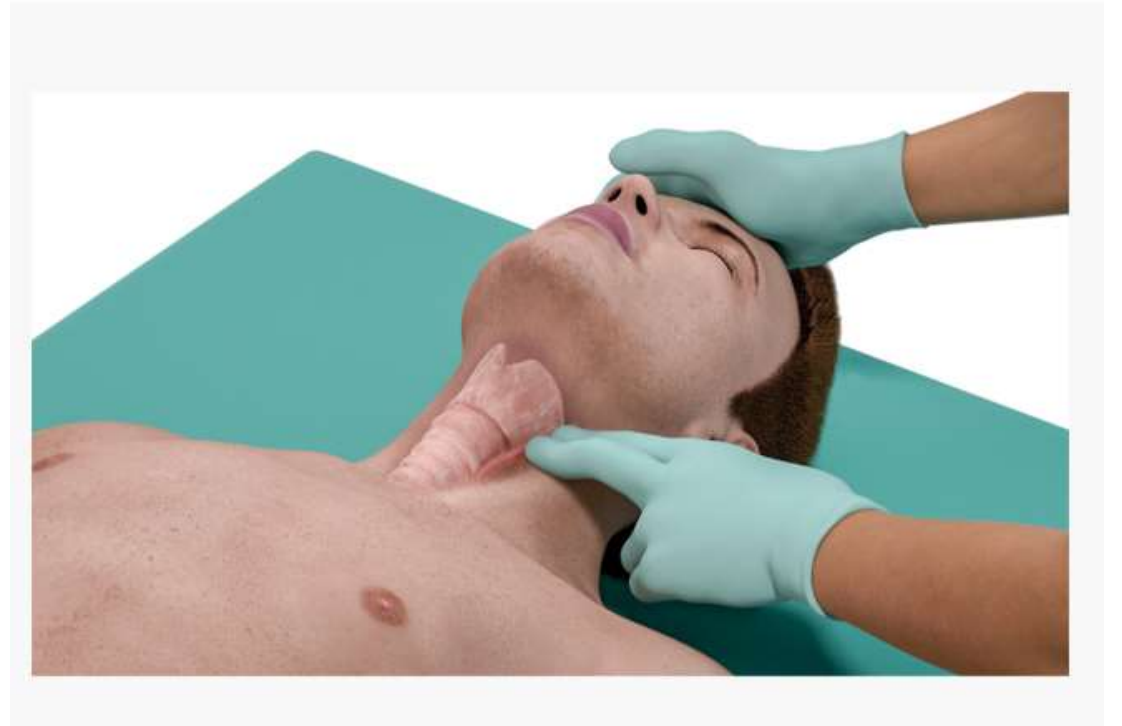
- Shout for nearby help.
- Activate the emergency response system.
- Get an AED if one is available, or send someone to activate the emergency response system and get an AED or defibrillator.



BLS assessment

Check for breathing and pulse.

For at least 5 but no more than 10 seconds



- If you find no breathing and no pulse within 10 seconds, start CPR, beginning with chest compressions.
- If you find a pulse, start rescue breathing at 1 breath every 6 seconds. Check pulse about every 2 minutes.

BLS assessment

- If pulse is not felt, check for a shockable rhythm with an AED/defibrillator as soon as it arrives.
- Provide shocks as indicated.
- Follow each shock immediately with CPR, beginning with compressions.



High-Quality CPR

- *Compress the chest hard and fast at least 5 cm at a rate of 100 to 120/min (30:2).*
- *Allow the chest to completely recoil after each compression.*
- *Switch compressors about every 2 minutes or earlier if fatigued—the switch should only take about 5 seconds.*
- *Minimize interruptions in compressions to 10 seconds or less*
- *Avoid excessive ventilation.*

Primary Assessment

- **Airway**
- **Is the patient's airway patent?** head tilt–chin lift, an oropharyngeal airway, or a nasopharyngeal airway
- **Is an advanced airway indicated?** laryngeal mask airway, endotracheal tube
- **Have you confirmed proper placement of the airway device?** physical examination and quantitative waveform capnography
- **Is the tube secured, and are you reconfirming placement frequently and with every transition?**

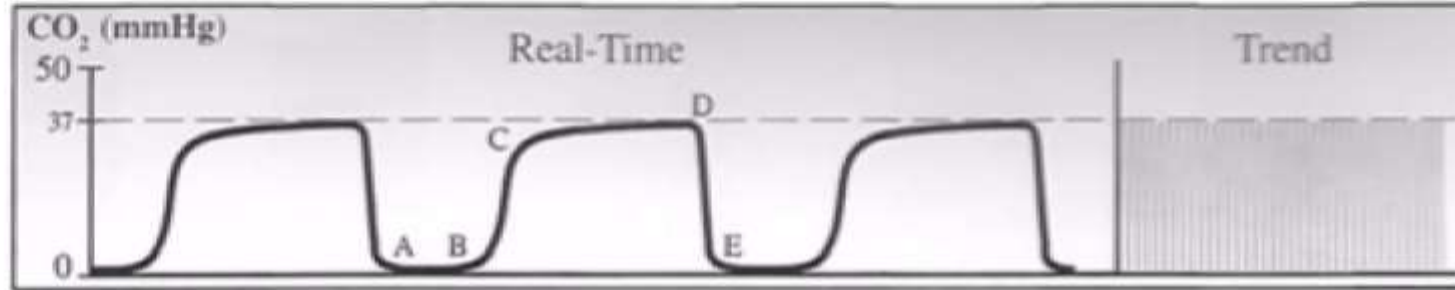
Primary Assessment

- **Breathing**
- Are ventilation and oxygenation adequate? administer 100% oxygen
- Are quantitative waveform capnography and oxyhemoglobin saturation monitored?
- - Clinical criteria (chest rise and cyanosis)
 - Quantitative waveform capnography
 - Oxygen saturation
 - Avoid excessive ventilation

Primary Assessment

- Circulation
 - Are chest compressions effective? Quantitative waveform capnography >20 mm Hg
 - What is the cardiac rhythm?
 - Is defibrillation or cardioversion indicated? VF, pVT
 - Has intravenous (IV)/intraosseous (IO) access been established? Give appropriate drugs / fluids to manage rhythm and blood pressure.
-
- Is ROSC present?
 - Is the patient with a pulse unstable?
 - Are medications needed for rhythm or blood pressure?
 - Does the patient need volume (fluid) for resuscitation?

Normal Wave



Normal Capnograph

This is the normal capnograph. A wave form is present; the wave form begins at the base line, raises steeply, plateaus with a gradual upslope, and quickly returns to the baseline. Finally, the end tidal CO₂ reading is within the **normal range of 35-45 mmHg**.

Waveform Characteristics

- A-B Baseline
- B-C Expiratory Upstroke
- C-D Expiratory Plateau
- D End Tidal Concentration
- D-E Inspiration Begins

Primary Assessment

- **Disability**
- Check for neurologic function.
- Quickly assess for responsiveness, levels of consciousness, and pupil dilation.
- AVPU: Alert, Voice, Painful, Unresponsive

Primary Assessment

- Exposure
- Remove clothing to perform a physical examination.
- Look for obvious signs of trauma, bleeding, burns, unusual markings, or medical alert bracelets.

Secondary Assessment

- **(H's and T's).**
- Hypovolemia, Hypoxia, Hydrogen ion (acidosis), Hypo-/hyperkalemia, Hypothermia
- Tension pneumothorax, Tamponade (cardiac), Toxins, Thrombosis (pulmonary), Thrombosis (coronary)

SAMPLE

- Signs and symptoms.
- Allergies.
- Medications.
- Past medical history.
- Last oral intake.
- Events leading up to current situations.

Bradycardia

- Bradycardia by definition, ie, heart rate typically less than 50 beats/min.
- Inadequate for the patient's condition (functional or relative).

Identify and Treat Underlying Causes

- Perform the Primary Assessment:
- **A:** Maintain patent airway.
- **B:** Assist breathing as necessary; give oxygen in case of hypoxia; monitor oxygen saturation.
- **C:** Monitor blood pressure, oximetry, and heart rate; obtain and review a 12-lead ECG; establish IV access.
- **D and E:** Conduct a problem-focused history and physical examination; search for possible hypoxic and toxicologic causes, and treat possible contributing factors.

- ***Signs and Symptoms:***

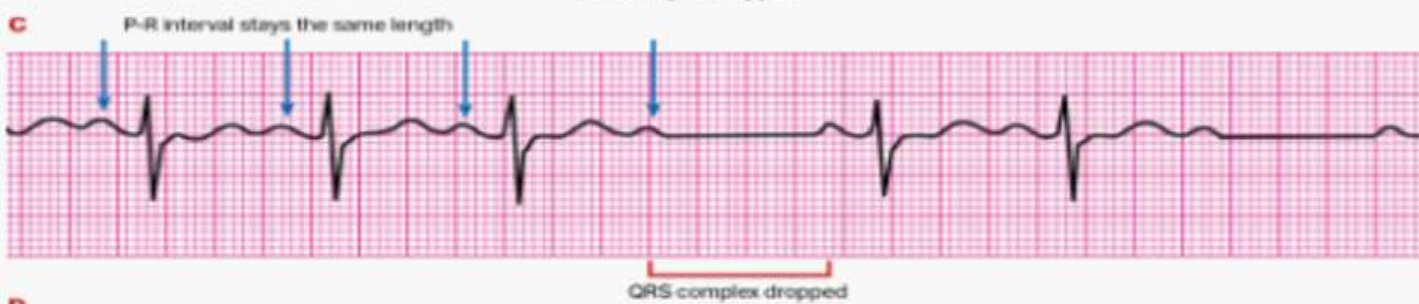
- Hypotension
- Acutely altered mental status
- Signs of shock
- Ischemic chest discomfort
- Acute heart failure

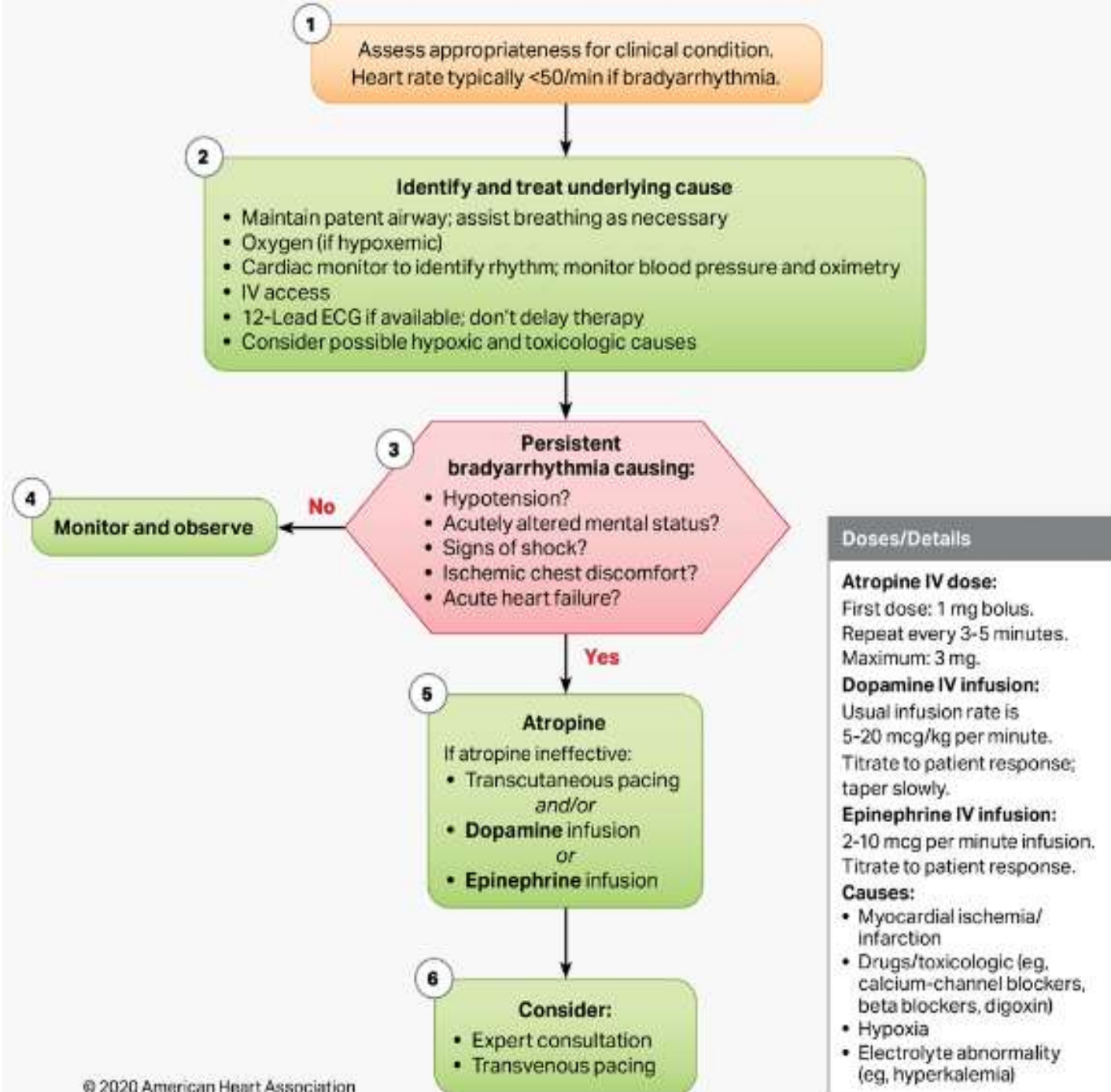
- **Drugs for bradycardia include:**

- Atropine
- Dopamine (infusion)
- Epinephrine (infusion)

- **Indications:**

1. The heart rate is slow.
2. The patient has symptoms.
3. The symptoms are due to the slow heart rate.





Tachycardia

- defined as an arrhythmia with a heart rate typically 100/min or greater.
- *Symptomatic tachycardia*: signs and symptoms due to the rapid heart rate.
- The rate takes on clinical significance at its extremes and is more likely attributable to an arrhythmia if the heart rate **is 150/min or greater**.
- It is unlikely that symptoms of instability are caused primarily by the tachycardia when the heart rate is less than 150/min unless the patient has impaired ventricular function.

- ***Signs and Symptoms:***

- Hypotension
- Acutely altered mental status
- Signs of shock
- Ischemic chest discomfort
- Acute heart failure



A



B



C

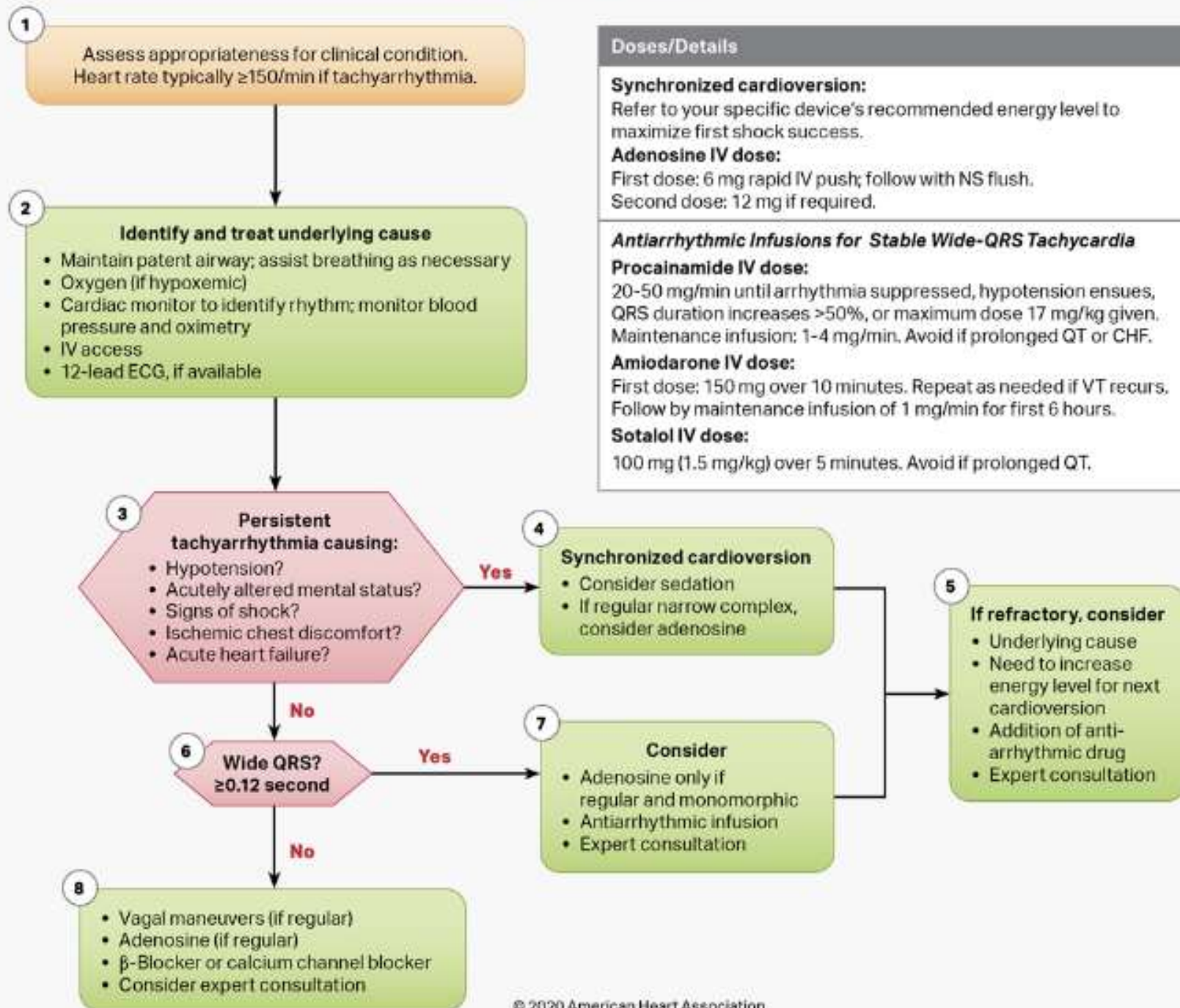


D



E





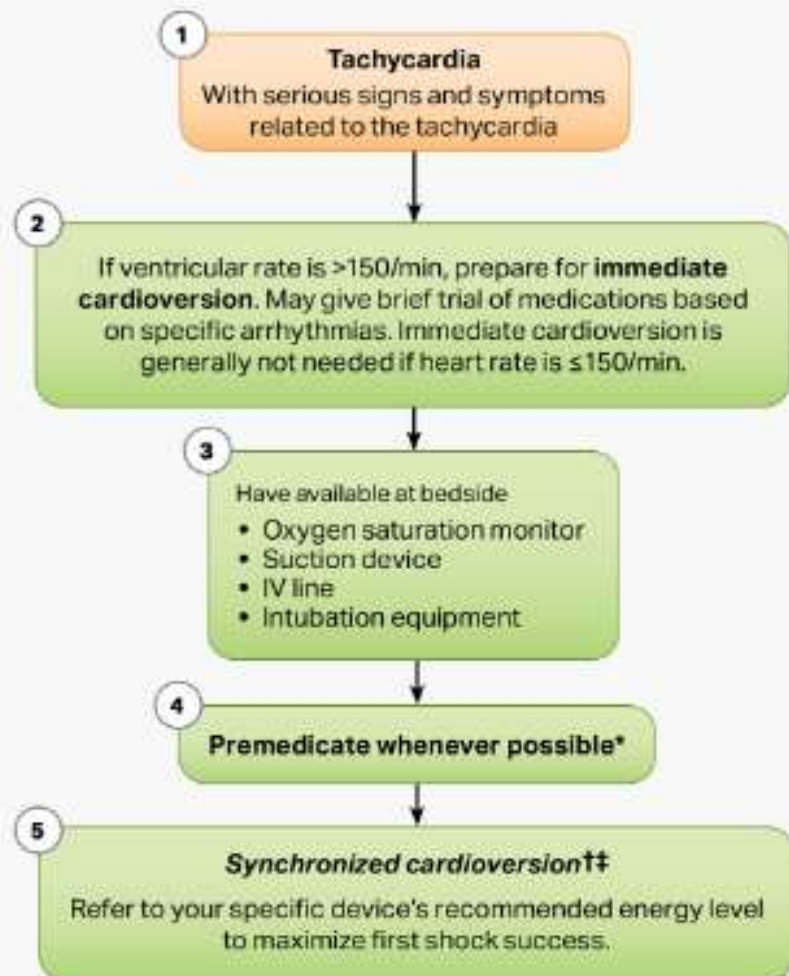


Caution: Sinus Tachycardia

Never cardiovert a patient who has a sinus rhythm.

- ***Serious Signs and Symptoms, Unstable Condition:***

- Are symptoms present or absent?
- Is the patient stable or unstable?
- Is there a wide QRS (0.12 second or greater)?
- Is the rhythm regular or irregular?
- Is the QRS monomorphic or polymorphic?



Notes

*Effective regimens have included a sedative (eg, diazepam, midazolam, etomidate, methohexital, propofol) with or without an analgesic agent (eg, fentanyl, morphine). Many experts recommend anesthesia if service is readily available.

†Note possible need to resynchronize after each cardioversion.

‡If delays in synchronization occur and clinical condition is critical, go immediately to unsynchronized shocks.

Synchronized cardioversion

- Sedate all conscious patients unless unstable or deteriorating rapidly.
- Turn on the defibrillator (monophasic or biphasic).
- Attach monitor leads to the patient and ensure proper display of the patient's rhythm.
- Press the sync control button to engage the synchronization mode.
- Look for markers on the R wave indicating sync mode.
- Select the appropriate energy level. Deliver synchronized shocks according to your device's recommended energy level to maximize the success of the first shock.
- Announce to team members: "Charging defibrillator—stand clear!"
- Press the charge button.
- Clear the patient when the defibrillator is charged.
- Press the shock button(s).
- Check the monitor. If tachycardia persists, increase the energy level (joules) according to the device manufacturer's recommendations.
- Activate the sync mode after delivery of each synchronized shock.



Critical Concepts: Drugs to Avoid in Patients With Irregular Wide-Complex Tachycardia

Avoid AV nodal blocking agents such as adenosine, calcium channel blockers, digoxin, and possibly β -blockers in patients with pre-excitation atrial fibrillation, because these drugs may cause a paradoxical increase in the ventricular response.

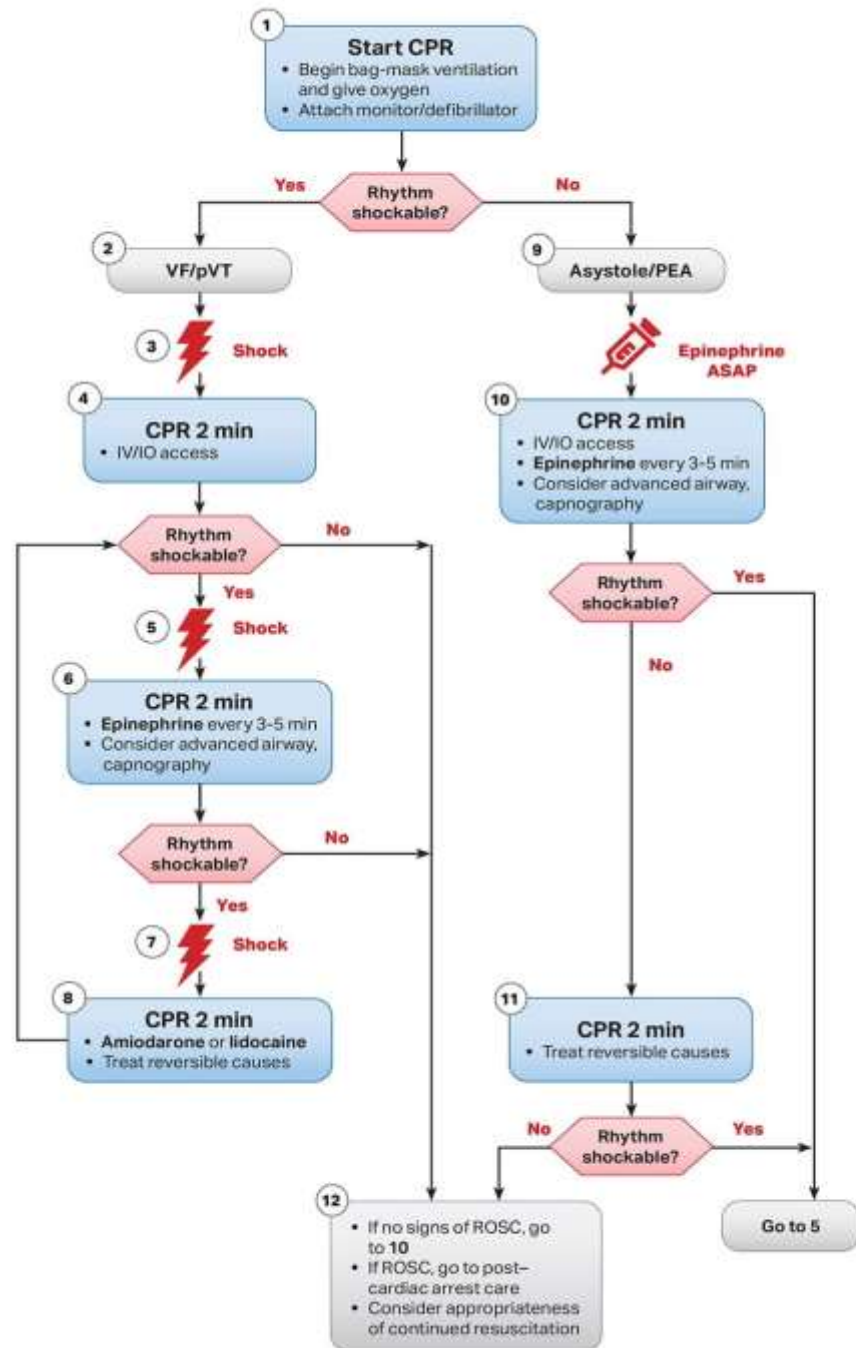


Critical Concepts: What to Avoid With AV Nodal Blocking Agents

Do not use AV nodal blocking drugs for pre-excited atrial fibrillation or flutter because these drugs are unlikely to slow the ventricular rate and may even accelerate the ventricular response. Also, be careful when combining AV nodal blocking agents of varying duration, such as calcium channel blockers or β -blockers, because their actions may overlap if given serially and provoke profound bradycardia.

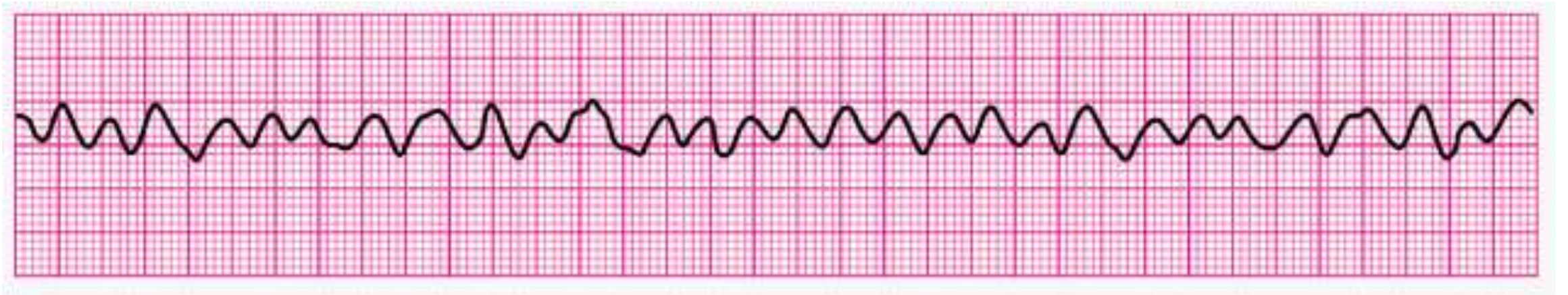
Cardiac arrest

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



High-Quality CPR
- Push hard (at least 2 inches [5 cm]). - Push 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, use 30:2 compression-ventilation ratio. - If advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions. - Continuous waveform capnography - If ETCO₂ 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
- ET intubation or supraglottic advanced airway - Continuous waveform capnography or capnometry to confirm and monitor ET tube placement
Reversible Causes
- Hypovolemia - Hypoxia - Hydrogen ion (acidosis) - Hypo-/hyperkalemia - Hypothermia - Tension pneumothorax - Tamponade, cardiac - Toxins - Thrombosis, pulmonary - Thrombosis, coronary

Cardiac Arrest: VF/pVT



- ***Drugs for VF/pVT:***

- Epinephrine
- Amiodarone
- Lidocaine
- Magnesium sulfate
- Dopamine
- Oxygen
- Other medications, depending on the cause of the VT/pVT arrest

Cardiac Arrest



Caution: Agonal Gasps

- *Agonal gasps may be present in the first minutes after sudden cardiac arrest.*
- *Agonal gasps are not normal breathing.*

A patient who gasps usually appears to be drawing air in very quickly. The mouth may be open and the jaw, head, or neck may move with gasps. Gasps may appear forceful or weak. Some time may pass between gasps because they usually happen at a slow, irregular rate. The gasp may sound like a snort, snore, or groan. Gasping is a sign of cardiac arrest.

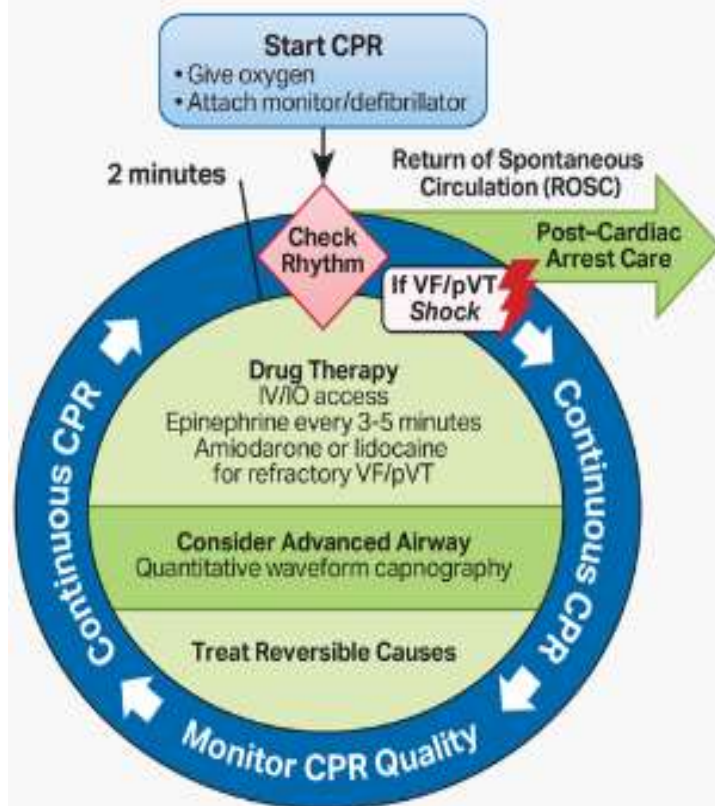
Feature 	Normal Breathing	Agonal Breathing
Rhythm	Regular, steady, and smooth	Extremely irregular and sporadic
Rate	12 to 20 breaths per minute	Very slow (often fewer than 8 breaths per minute)
Sound	Quiet	Snoring, snorting, gurgling, groaning, or heavy gasping
Appearance	Normal chest rise and fall	Labored gulping, twitching, or "fish-out-of-water" jaw movements
Pauses	None	Long, unpredictable pauses between gasps
Awareness	Conscious and alert	Unconscious and completely unresponsive

Cardiac Arrest

- *Do not exceed 10 seconds for the pause in chest compressions to check the rhythm*
- **For persistent VF/pVT, give 1 shock and immediately resume CPR for 2 minutes, beginning with chest compressions.**

Cardiac Arrest

- give **epinephrine** 1 mg IV/IO during CPR after the second shock, and repeat every 3 to 5 minutes, or every 4 minutes as a midrange.
- **Amiodarone:** 300 mg IV/IO bolus, then consider 1 additional 150 mg IV/IO
- **Lidocaine:** 1 to 1.5 mg/kg IV/IO first dose, then 0.5 to 0.75 mg/kg IV/IO at 5- to 10-minute intervals, to a maximum dose of 3 mg/kg
- **Magnesium sulfate** for torsades de pointes, loading dose 1 to 2 g IV/IO diluted in 10 mL (eg, D₅W, normal saline) given as IV/IO bolus, typically over 20 minutes



CPR Quality

- Push hard (at least 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.
- 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 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 |



Critical Concepts: Administer Epinephrine

Give epinephrine as soon as IV/IO access becomes available.

- *With respect to timing, for cardiac arrest with a nonshockable rhythm, it is reasonable to administer epinephrine as soon as feasible.*
- *Epinephrine 1 mg IV/IO—repeat every 3 to 5 minutes, or every 4 minutes as a midrange (ie, every other rhythm check)*

Administer drugs during CPR. Do not stop CPR to administer drugs.

With respect to timing, for cardiac arrest with a nonshockable rhythm, it is reasonable to administer epinephrine as soon as feasible. A recent systematic review found an association between earlier epinephrine and ROSC for patients with nonshockable rhythms, although improvements in survival were not universally seen.¹⁷

Prioritize establishing IV/IO access over managing an advanced airway unless bag-mask ventilation is ineffective or hypoxia caused the arrest. All high-performance team members must search for an underlying and treatable cause of the PEA while they perform their assigned roles.



Summary

- [Systematic Approach](#)
- [Bradycardia](#)
- [Tachycardia](#)
- [Cardiac Arrest](#)