The following protocol is intended for the systematic treatment of common cardiac dysrhythmia and cardiac arrest scenarios. Perform all assignments in “Pit Crew” fashion and make all efforts to obtain a Return of Spontaneous Circulation (ROSC) prior to leaving the scene.

A. CPR Guidelines

CPR will be performed according to the most current American Heart Association (AHA) standards. Always keep in mind that high-quality CPR with **uninterrupted chest compressions, early defibrillation, and early ventilation** are the top priorities when attempting to resuscitate a pulseless and apneic patient. When performing CPR, the following guidelines will be adhered to:

1. Check for responsiveness, looking for no breathing or occasional gasps while simultaneously checking for a pulse.

2. If no pulse, perform high-quality, uninterrupted chest compressions at least 2” (5 cm) to 2.4” (6 cm) deep and at a rate of 100 to 120/min.

3. Allow for full chest recoil after each chest compression by not leaning on the chest.

4. MINIMIZE INTERRUPTIONS in chest compressions.

5. **Do not interrupt compressions for more than 10 seconds.**

a) Rotate compressor every 2 minutes, or sooner to limit rescuer fatigue to provide high-quality chest compressions.

During defibrillation attempts, perform chest compressions while AED/cardiac monitor is charging.

6. **Avoid excessive ventilation**:

   a) When ventilating without an advanced airway, perform cycles of 30 compressions with a short pause to administer 2 breaths per cycle.

   b) When an advanced airway (supraglottic/endotracheal) is in place, provide continuous compressions at a rate of at least 100 to 120/min and ventilate the patient once every 6 seconds. (10 breaths/min)

7. High quality chest compressions are achieved when the ETCO2 value is at least 10 mmHg or greater.

8. All patients found in cardiac arrest or who arrest prior to transport will be resuscitated in place (limit movement, no attempts in loading or transport). Patient transportation for definitive care can be done as soon as **ALL** the following have been established:

   a) Initiation of CPR (device assisted or manual)
   b) Establishment of an airway (supraglottic/endotracheal) with end tidal CO2 monitoring
   c) Establishment of vascular access (IV or IO)
   d) Completion of 4 full cycles of CPR (to include medications and evaluation of cardiac rhythm strip for possible defibrillation)

   Our goal is to provide high quality resuscitation in the pre-hospital setting. We aim to stabilize the patient, optimize circulation and oxygenation, and prepare for transport to the nearest appropriate facility while also considering the safety of both the patient and the crew. Even if all four criteria are met, it is up to the judgement of the paramedics on scene to determine when patient transport is appropriate.

9. If resuscitation efforts have begun **and** if the patient meets criteria for termination of resuscitation as per **Protocol 27**, resuscitative efforts should be performed on scene for 20 minutes (See **Protocol 27**, Section C, #2).

Top

B. Cardiopulmonary Resuscitation

EMR/BLS

1. Initial Assessment **Protocol 1**. The "Pit Crew" approach will be used, and initial procedures/treatments will be completed concurrently.
    a) Assess for responsiveness.

    b) Simultaneously look for no breathing or occasional gasps and check for a pulse, to reduce the time to first chest compression.

    The initial assessment should take no more than 10 seconds to complete.

2. If the patient has a pulse, but is not breathing:

    a) Open the airway.

    b) Give 2 full ventilations with BVM to determine airway patency. If obstructed, see **Protocol 7** Section E.

    c) Continue to ventilate patient while advanced airway device is prepared for insertion.

        a. Insert supraglottic airway (SGA) if airway is patent and no gag reflex is present.

    d) Provide 1 rescue breath every 6 seconds (10 breaths/min).

    Note: SGA can be utilized by EMTs through departmental approval.

3. If the patient has no pulse:

    a) Perform immediate chest compressions. Only interrupt chest compressions to analyze rhythm and to determine airway patency.

    b) Give 2 full ventilations with BVM to determine airway patency.

    c) Insert SGA if airway is patent. If obstructed, see **Protocol 7**, Section E.

    d) If SGA is utilized, perform asynchronous ventilations 1 every 6 seconds (if no SGA, continue with 30 compressions and 2 ventilations).

    Note: SGA can be utilized by EMTs through departmental approval.

4. Apply the AED as soon as possible:

Top

a) Follow the AED prompts and if shock is advised, deliver shock as soon as possible.

If shock is advised, minimize interruptions in chest compressions before and after shock by performing chest compressions while the AED is charging.

b) Leave the AED on the patient and turned on throughout the resuscitation effort.

c) The AED will prompt a reassessment of a pulse and rhythm analysis every 2 minutes.

d) Resume CPR beginning with chest compressions immediately after each shock and continue to follow the prompts of the AED.

e) Consider the application of the Lucas device at pulse checks. Manual chest compressions should be continued during the placement of mechanical compression device. Do not interrupt compressions for more than 10 seconds.

ALS

5. Initial Assessment **Protocol 1.** The "Pit Crew" approach will be used, and initial procedures/treatments will be completed concurrently.

   a) Assess for responsiveness.

   b) Simultaneously look for no breathing or occasional gasps and check for a pulse, to reduce the time to first chest compression.

   The initial assessment should take no more than 10 seconds to complete.

6. If the patient has a pulse, but is not breathing:

   a) Open the airway

   b) Give 2 full ventilations with BVM to determine airway patency. If obstructed, see **Protocol 7**, Section E

   c) Insert SGA if airway is patent.

   d) Provide 1 rescue breath every 6 seconds (10 breaths/min)**.**

   e) Attach and monitor End Tidal CO_2 and waveform capnography **Procedure 11**.

   Note: SGA can be utilized by EMTs through departmental approval.

Top

7. If the patient has no pulse:

   e) Perform immediate chest compressions. Only interrupt chest compressions to analyze rhythm and to determine airway patency.

   f) Insert SGA if airway is patent. If obstructed, see **Protocol 7**, Section E.

      i. Intubation should only be performed if you are unable to successfully manage the patient's airway with an SGA, see **Procedure 49** for contraindications.

   g) Provide 1 ventilation every 6 seconds (10 breaths/min.).

   h) Attach and monitor End Tidal CO_2 and waveform capnography **Procedure 11**.

   Note: SGA can be utilized by EMTs through departmental approval.

   i) Reassess for a pulse every 2 minutes.

8. Immediately apply and attach the defibrillator pads.

9. Turn on the Monitor/Defibrillator and switch the monitor to "paddles."

10. Analyze for a shockable rhythm:

    a. Ventricular Fibrillation (V-Fib or VF)
    b. Pulseless Ventricular Tachycardia (pVT)
    c. Torsades de Pointes or Polymorphic VT

11. If the patient presents with a shockable rhythm, deliver shock as soon as possible.

    a. **Defibrillate at 360 joules** every 2 minutes as indicated.

    b. **Resume CPR** beginning with chest compressions immediately after each shock.

    c. Consider the application of the Lucas device at pulse checks. Manual chest compressions should be continued during the placement of mechanical compression device. Do not interrupt compressions for more than 10 seconds.

12. If the patient does not present with a shockable rhythm:

    a. **Resume CPR** beginning with chest compressions after each reassessment.

13. Reassessment shall be done after every 2 minutes of CPR, simultaneously checking for a pulse and confirming the underlying rhythm.

Top

14. Establish vascular access via IV (preferred) or IO **Procedure 14** as soon as possible without delaying chest compressions.

15. Deliver medications in accordance with the rhythm-based protocol the patient is being treated under the proceeding sections in this protocol.

C. Ventricular Fibrillation/Pulseless Ventricular Tachycardia (VF/pVT)

ALS

1. **Defibrillate at 360 joules.**

   a) Analyze for a shockable rhythm and repeat defibrillation as necessary for recurrent VF/pVT after every 2 minutes of high-quality CPR.

2. **Establish vascular access via IV (preferred) or IO Procedure 14** as soon as possible without delaying chest compressions.

3. Administer **Epinephrine 1 mg/10mL,** IV/IO push every 3-5 minutes for the duration of the arrest.

   a) Follow the drug administration with a 10 – 20 mL NS flush and high-quality CPR to circulate for 2 minutes prior to another rhythm analysis and pulse check.

4. Establish an advanced airway (supraglottic or endotracheal) **Protocol 07** at this point forward with limited to no interruptions in CPR and monitor with continuous quantitative waveform capnography (EtCO2).

5. Administer **Amiodarone *OR* Lidocaine**. The selection of ***one*** anti-arrhythmic will continue for the remainder of the VF/pVT algorithm.

   NOTE: Amiodarone is contraindicated in patients taking Coumadin (Warfarin).

   a) **Amiodarone**
      i. Initial dose: **300 mg** IV/IO push
      ii. Second dose: **150 mg** IV/IO push (If arrythmia continues after subsequent defibrillation attempt or reoccurs)

   OR

   b) **Lidocaine**

      i. Initial dose: **1.5 mg/kg** IV/IO push
      ii. Additional dose: **0.75 mg/kg** IV/IO push in 5 minutes, repeated once to a maximum total dose of **3 mg/kg**

   Follow the drug administration with a 10-20 mL NS flush and high-quality CPR to circulate for 2 minutes prior to another rhythm analysis and pulse check.

Top

6. If the rhythm fails to convert, continue CPR with Epinephrine IV/IO every 3-5 minutes and defibrillation as needed.

   a) At any time begin considering the underlying causes and manage as indicated in **"Potentially Reversible Causes in Cardiac Arrest" (H's and T's)** **Section E**.

7. If patient presents with suspected polymorphic ventricular tachycardia (**Torsades de Pointes**). **Magnesium Sulfate 2 gm slow IV/IO** may be given at any time after the first epinephrine.

8. Consider **Sodium Bicarbonate 1 mEq/kg** if the patient is suspected to have one of the following conditions:

   a) Chronic renal failure
   b) Hyperkalemia
   c) Known Tricyclic Antidepressant (TCA) Overdose
   d) Suspected Hyperactive Delirium Syndrome with Severe Agitation.
   e) Known aspirin overdose

   NOTE: Sodium Bicarbonate should not be routinely used in cases of extended down time.

9. If ROSC is achieved, refer to the Post Resuscitative Care Protocol, **Section L**.

D. Asystole

Agonal Rhythm, Idioventricular rhythm with a rate of 20 bpm or less, or Pulseless Bradycardias

ALS

Establish TWO vascular access sites via IV (preferred) or IO **Procedure 14** as soon as possible without delaying chest compressions.

1. Administer **Epinephrine 1 mg/10mL** IV/IO every 3-5 Minutes.

2. Consider underlying causes and manage as indicated in **"Potentially Reversible Causes in Cardiac Arrest" (H's and T's)** in **Section E**.

3. Administer **Calcium Chloride**, **1 gm (1,000 mg)** slow IV/IO.

4. Administer **Sodium Bicarbonate 1 mEq/kg** IV/IO.

NOTE: DO NOT administer Calcium Chloride and Sodium Bicarbonate through the same IV tubing, consider establishing separate access. If unable to gain two separate access, ensure line is sufficiently flushed with normal saline prior to administration.

Top

E. Pulseless Electrical Activity (PEA)

ALS

1. **Establish TWO vascular access sites via IV (preferred) or IO** Procedure 14 as soon as possible without delaying chest compressions.

2. Administer **Epinephrine 1 mg/10mL** IV/IO every 3-5 Minutes.

3. Consider underlying causes and manage as indicated in "**Potentially Reversible Causes in Cardiac Arrest" (H's and T's).**

Potentially Reversible Causes in Cardiac Arrest (H's and T's)	
Hypovolemia	Fluid bolus of up to 1000 mL
Hypoxemia	Confirm adequacy of oxygenation, airway management, consider establishing advanced airway.
Hydrogen-ions (Acidosis)	Provide assisted ventilation with an advanced airway (supraglottic or endotracheal) and monitor EtCO2 Administer Sodium Bicarbonate 1 mEq/kg IV/IO
Hypothermia	Warming of patient
Hypoglycemia	D10 10 gm (100 mL) IV/IO
Hyperkalemia	Calcium Chloride 1 gm (1000 mg) slow IV/IO and/or Sodium Bicarbonate 1 mEq/kg IV/IO
Tension Pneumothorax	Perform chest needle decompression **Procedure 5**
Tamponade, Cardiac	Outside of EMS Scope of Practice – Transport to closest most appropriate hospital
Toxins	Refer to **Protocol 15**
Thrombosis (Pulmonary/Coronary)	Transport to a STEMI – PCI capable facility
Trauma	Refer to **Section N**

4. For patients with trauma to the torso that are in traumatic arrest, perform bilateral needle decompression **Procedure 5**. This is done to ensure there is no tension pneumothorax as the cause of the cardiac arrest.

F. Wide Complex Tachycardia – Regular (Monomorphic) with a Pulse

ALS

Wide Complex Tachycardia – Regular (Monomorphic) with a Pulse

UNSTABLE - Patient presents with persistent tachyarrhythmia with signs of: Hypotension, acute AMS, signs of shock, ischemic chest discomfort, and/or acute heart failure.

1. If conscious, attempt to sedate by administering **Midazolam (Versed) 5 mg** IV/IM. DO NOT delay cardioversion to administer Versed if the patient is profoundly unstable.

2. Perform **Synchronized Cardioversion** until the rhythm is converted, by reassessment of underlying rhythm and the presence of a pulse after each energy delivery:

    a) 100 joules
    b) 200 joules
    c) 300 joules
    d) 360 joules

3. Administer **Amiodarone** regardless of rhythm conversion.

    a) **Amiodarone 150 mg IV over 10 minutes.** Mix 150 mg (3 mL) into a 50 mL NS bag with a 10 gtts/mL set and run at 60 gtts/min may be repeated once in 10 minutes.

    b) **If Amiodarone is contraindicated, administer Lidocaine 1 mg/kg IVP.** This may be repeated at .75mg/kg twice if rhythm fails to convert.

4. If the rhythm fails to convert, continue **synchronized cardioversion** at 360 joules every 2 minutes.
5. If the patient's condition deteriorates at any time and becomes unresponsive and pulseless, move immediately to VF/Pulseless VT, **Section C**.
6. Once patient converts, maintain a systolic B/P 90 mmHg or greater with a fluid bolus of up to 1000 mL.
7. If BP remains less than 90 mmHg, administer **Epinephrine Infusion 5 mcg/min.** Titrate to desired effect up to 40 mcg/min**.** **Appendix 9.2**

Top

Mix Epinephrine 1mg/1mL, 10 mg (10 mL) into a 500mL NS bag with a 60 gtt/mL set to yield a concentration of 20 mcg/mL and begin administration at approximately 1 drop every 4 seconds and titrate to desired effect. Max dose of 40 mcg/minute (2 drops every second).

8. If the desired effects are not achieved with the Epinephrine Infusion, administer **Dopamine Infusion of 10 mcg/kg/minute and titrate to desired effect up to a max dose of 20 mcg/kg/minute. Appendix 9.1.**

Wide Complex Tachycardia – Regular (Monomorphic) with a Pulse

STABLE PATIENT

1. Consider **Adenosine 6 mg** rapid IVP **once,** as a diagnostic tool if the rhythm appears regular and QRS complexes are monomorphic.

2. Administer **Amiodarone 150 mg IV over 10 minutes.** Mix 150 mg (3 mL) into a 50 mL NS bag with a 10 gtt/mL set and run at 60 gtts/min may be repeated every 10 minutes.

3. If Amiodarone is contraindicated, administer Lidocaine 1 mg/kg IVP.

4. If the patient's condition deteriorates at any time and becomes unresponsive and pulseless, move immediately to "*unstable adult patient*" above, or to VF/Pulseless VT, **Section C**.

G. Torsades de Pointes – Irregular (Polymorphic VT)

Patients presenting with polymorphic (irregular) VT require immediate defibrillation. For polymorphic VTs, due to the QRS complex appearance, it will be virtually impossible for cardiac monitors to recognize the morphology of the irregular complexes in order to deliver synchronized electrical therapy. Although some patients may present with a pulse, it typically will deteriorate quickly to a pulseless VT.

ALS

UNSTABLE - Patient presents with persistent tachyarrhythmia with signs of: Hypotension, acute AMS, signs of shock, ischemic chest discomfort, and/or acute heart failure.

1. If conscious, attempt to sedate by administering **Midazolam (Versed) 5 mg** IV/IM. DO NOT delay defibrillation to administer Versed if the patient is profoundly unstable.

2. Perform **Defibrillation** until the rhythm has converted:

   a) 360 joules

Top

3. **Administer Magnesium Sulfate 2 gm IV over 5 minutes** regardless of rhythm conversion.

4. Continue **Defibrillation** at 360 joules until rhythm converts.

5. If the patient's condition deteriorates at any time and becomes unresponsive and pulseless, move immediately to VF/Pulseless VT, **Section C**.

6. Once patient converts, maintain a systolic B/P 90 mmHg or greater with a fluid bolus of up to 1000 mL.

7. If fluids are unsuccessful, administer **Epinephrine Infusion 5 mcg/min** and titrate to desired effect up to 40 mcg/min.

STABLE PATIENT

1. Administer **Magnesium Sulfate 2 gm IV over 5 minutes.** Mix 2 gm (4 mL) into a 50 mL NS bag with a 10 gtt/mL set and run at 60 gtts/min.

2. If the patient's condition deteriorates at any time, move immediately to "*Unstable adult patient*" above, or to VF/Pulseless VT, **Section C**.

H. Narrow Complex Tachycardia (HR 150 or greater) with a Pulse

Identify and treat the underlying causes according to Protocol 1 prior to the initiation of this section of the protocol. Sustained heart rates 150 or greater associated with clinical conditions of instability can depend on the age of the patient and are usually related to other conditions (e.g. increased levels of pain, febrile (sepsis), anxiety, shock, etc.) and not primarily associated with a cardiac event. Therefore, a focused initial assessment of the patient is crucial to determine the underlying cause prior to any treatment or intervention.

ALS

UNSTABLE - Patient presents with persistent tachyarrhythmia with signs of: Hypotension, acute AMS, signs of shock, ischemic chest discomfort, and/or acute heart failure.

2. Attempt to sedate by administering **Midazolam (Versed) 5 mg** IV/IM. DO NOT delay cardioversion to administer Versed if the patient is profoundly unstable.
3. Perform **Synchronized Cardioversion** until the rhythm is converted, by reassessment of underlying rhythm and the presence of a pulse after each energy delivery:
    a) 100 joules
    b) 200 joules
    c) 300 joules
    d) 360 joules

Top

4. If ascending cardioversions are unsuccessful, administer **Adenosine** per the *Stable* Section if not already administered, as a diagnostic tool to determine underlying rhythm.

5. If the rhythm fails to convert, continue **synchronized cardioversion** at 360 joules until rhythm converts.

6. If the patient's condition deteriorates at any time and becomes unresponsive and pulseless, move immediately to Cardiopulmonary Resuscitation, **Section B** and follow most appropriate algorithm for the rhythm presented.

After successful conversion maintain O2 saturation 94% or greater and treat hypotension if BP is less than 90 mmHg with fluids (up to 1000 mL NS IV) and possibly Epinephrine Infusion 5 mcg/min. Mix Epinephrine 1mg/1mL, 10 mg (10 mL) into a 500mL NS bag with a 60 gtt/mL set to yield a concentration of 20 mcg/mL and begin administration at approximately 1 drop every 4 seconds and titrate to desired effect. Max dose of 40 mcg/minute (2 drops every second).

Narrow Complex Tachycardia (HR 150 or greater) with a Pulse

STABLE PATIENT

ALS

1. Attempt **Vagal Maneuvers.**

2. Administer **Adenosine 6 mg** rapid IVP (over 1-2 seconds).

    a. Adenosine should be administered through a large-bore catheter preferably at the antecubital fossa and followed by a rapid flush of 20 mL of IV solution.

DO NOT Administer Adenosine if ECG Rhythm is A-Fib or A-Flutter or if patient is taking *Persantine* or Aggrenox.

NOTE: If Atrial Fibrillation/Flutter is observed proceed to Section I do not administer any additional doses of Adenosine.

3. If no change after 1 minute, repeat **Adenosine 12 mg** rapid IVP (over 1-2 seconds).

4. If no change after 1 minute, administer **Diltiazem 0.25 mg/kg slow IV over 2 minutes** (MAX 20 mg).

5. If after 15 minutes, patient fails to convert clinical judgement may be used to determine if an additional dose of **Diltiazem 0.35 mg/kg** slow IV over 2 minutes (maximum dose of 25 mg) is required or treat as unstable.

6. If the patient's condition deteriorates at any time and becomes unresponsive and pulseless, move immediately to Cardiopulmonary Resuscitation, **Section B** follow the most appropriate algorithm for the rhythm presented.

I. Atrial Fibrillation/Atrial Flutter

Patients in atrial fibrillation/flutter with a rapid ventricular rate of 150 bpm or greater.

ALS

STABLE PATIENT

1. Administer **Diltiazem 0.25 mg/kg slow IV push over 2 minutes** (MAX 20 mg).

   If no conversion after 15 minutes:

2. **Diltiazem 0.35 mg/kg slow IV push over 2 minutes** (MAX 25 mg).

UNSTABLE - Patient presents with persistent tachyarrhythmia with signs of: Hypotension, acute AMS, signs of shock, ischemic chest discomfort, and/or acute heart failure.

3. Attempt to sedate by administering **Midazolam (Versed) 5 mg** IV/IM. DO NOT delay cardioversion to administer Versed if the patient is profoundly unstable.

4. Perform **Synchronized Cardioversion** until the rhythm is converted, by reassessment of underlying rhythm and the presence of a pulse after each energy delivery:
   a) 200 joules
   b) 300 joules
   c) 360 joules

5. If the patient's condition deteriorates at any time and becomes unresponsive and pulseless, move immediately to Cardiopulmonary Resuscitation, **Section B** and follow most appropriate algorithm for the rhythm presented.

J. Premature Ventricular Complexes (PVCs)

ALS

1. If the patient is having significant PVCs, without SOB, administer **Oxygen to maintain a saturation between 90% - 98%.**

Top

a) Significant (Malignant) PVCs:

i. Closely coupled (R on T).
ii. Multiform in configuration.
iii. Occurring in short bursts of two or more in succession; or
iv. Runs of ventricular tachycardia.

2. Administer **Amiodarone OR Lidocaine**.

a) **Amiodarone 150 mg IV over 10 minutes.** Mix 150 mg (3 mL) into a 50 mL NS bag with a 10 gtt/mL set and run at 60 gtts/min may be repeated once in 10 minutes.

NOTE: Amiodarone is contraindicated in patients taking Coumadin (Warfarin).

b) If Amiodarone is contraindicated, administer **Lidocaine 1 mg/kg.** May be repeated in 5 minutes. Max total dose of 3 mg/kg.

c) If the rhythm was converted with Lidocaine following an episode of VT and the patient is not in profound hypotension or a high-degree heart-block (2nd degree Type II, 3rd degree, or an idioventricular rhythm).

i. Administer a maintenance drip of **Lidocaine 2 mg/min** IV/IO and titrate up to a max dose rate of **4 mg/min** if necessary for the suppression of ectopy.

ii. Patients with hepatic disease (liver/renal failure) or 70 years of age or older, begin a maintenance dose at **1 mg/min.**

K. Symptomatic Bradycardia

Symptomatic bradycardia is a heart rate less than 50/min that elicits signs and symptoms of CP, AMS, SOB, and/or poor or inadequate perfusion.

ALS

STABLE - Patient is NOT hypotensive

1. Monitor the patient, treat signs and symptoms and transport to a STEMI facility.

2. Perform a rhythm strip and 12-Lead ECG (R/O AMI), as an attempt to determine the underlying cause.

3. Consider possible hypoxia or toxicological causes.

SYMPTOMATIC BRADYCARDIA – Patient presents with persistent bradyarrhythmia with signs of: Hypotension, acute AMS, signs of shock, ischemic chest discomfort, and/or acute heart failure.

Top

If a patient is in 2nd degree type II or 3rd degree AV Block, go directly to step 2. Do not administer Atropine.

1. Administer **Atropine, 1 mg** IV. This may be repeated every 3-5 minutes until the maximum total dose of 3 mg is reached.

2. If Atropine is unsuccessful, begin **External Pacing (TCP), Procedure 23**

   a) If conscious and BP greater than 90 systolic, attempt to sedate by administering **Midazolam (Versed) 5 mg** slow IV/IO. DO NOT delay TCP to administer Versed if the patient is profoundly unstable.

   b) Following successful electrical/mechanical capture, if BP remains less than 90 mmHg give a **fluid bolus up to 1000 mL**. Monitor B/P and lung sounds often.

   c) If BP remains less than 90 mmHg, administer **Epinephrine Infusion 5 mcg/min.** Titrate to desired effect up to 40 mcg/min**.** Appendix 9.2.

3. Mix Epinephrine 1mg/1mL, 10 mg (10 mL) into a 500mL NS bag with a 60 gtt/mL set to yield a concentration of 20 mcg/mL and begin administration at approximately 1 drop every 4 seconds and titrate to desired effect. Max dose of 40 mcg/minute (2 drops every second).

4. If TCP is unavailable or its use is unsuccessful (no capture), administer **Epinephrine Infusion 5 mcg/min** and titrate to desired effect up to a max of **40 mcg/min**. Appendix 9.2

5. If the desired effects are not achieved with the Epinephrine Infusion, administer **Dopamine Infusion of 10 mcg/kg/min and titrate to desired effect up to a max dose of 20 mcg/kg/min. Appendix 9.1.**

L. Post Resuscitation Care (ROSC)

ROSC- The restoration of a sustained perfusing cardiac rhythm that results in effective blood flow, indicated by a palpable pulse and/or measurable blood pressure without ongoing chest compressions. If ROSC is lost, continue to treat the appropriate algorithm.

1. Optimize ventilation and oxygenation

   a) Perform Airway Management with an advanced airway (supraglottic or endotracheal) Protocol 07 if the patient remains comatose and an advanced airway has not already been established.

Top

b) Maintain oxygen saturation between 90% - 98% to avoid potential oxygen toxicity due to excessive ventilation, ventilate at a rate of 1 breath every 6 seconds (10 breaths/min), and titrate to a target ETCO2 35-45 mmHg.

c) Glycemic control measures should be implemented since there is an increased risk for hypoglycemia in the post-arrest phase. Measure and maintain BG levels. If BG level less than 70 mg/dL administer **D10 10 grams (100 mL)** IV/IO.

2. If blood pressure is less than 90 mmHg systolic:

a) Administer a **fluid bolus up to 1000 mL of NS**. Monitor B/P and lung sounds often it is not mandatory to administer the entire liter of fluid prior to proceeding to Vasopressors. Clinical judgment should be utilized in determining when to proceed to Vasopressors.

b) If BP remains less than 90 mmHg, administer **Epinephrine Infusion 5 mcg/min.**

Mix Epinephrine 1mg/1mL, 10 mg (10 mL) into a 500mL NS bag with a 60 gtt/mL set to yield a concentration of 20 mcg/mL and begin administration at approximately 1 drop every 4 seconds and titrate to desired effect. Max dose of 40 mcg/minute (2 drops every second). **Appendix 9.2**

c) If the desired effects are not achieved with the Epinephrine Infusion**,** administer **Dopamine Infusion** at **10 mcg/kg/min** and titrate to effect to achieve a blood pressure of 90-100 mmHg systolic, max dose rate of **20 mcg/kg/min**. **Appendix 9.1**

Post cardiac arrest patients with systolic blood pressures less than 90 mmHg are associated with higher mortality and diminished functional recovery, while systolic pressures of greater than 100 mmHg are associated with better recovery.

3. Obtain a **12-Lead EKG.**

a) If STEMI, treat per **Protocol 11** ST Elevation Myocardial Injury/STEMI.

Patients who have achieved ROSC in the field WILL BE transported to the nearest STEMI facility.

4. If after pulses are restored, patient develops malignant ventricular ectopy, (Couplet PVCs, Multiform in configuration, occurring in short bursts of two or more in succession, or runs of VT) with B/P 90 mmHg or greater administer **Amiodarone 150 mg** IV over 10 minutes.

Top

5. If ROSC was achieved prior to the administration of an anti-arhythmic to a patient with VF/pVT, administer **Amiodarone 150 mg** IV over 10 minutes.

6. If the patient was resuscitated with **Lidocaine** following an episode of VF/pVT and converted into a perfusing rhythm that is not in profound hypotension; or a high-degree heart block (2nd degree Type II, 3rd degree, or Idioventricular rhythm).

   a) Administer a maintenance drip of **Lidocaine 2 mg/min** IV/IO and titrate up to a max dose rate of **4 mg/min** if necessary for the suppression of ectopy.

      i. Patients with hepatic disease (liver/renal failure) or greater than 70 years of age, begin maintenance dose at **1 mg/min.**

M. Cardiac Arrest in Pregnancy

EMR/BLS

a) Begin cardiopulmonary resuscitation as outlined in **Section B**.

b) Perform a manual displacement of the uterus towards the left for a patient in the third trimester (greater than 20 weeks gestational size).

1-handed technique

2-handed technique

3. Perform airway management **Protocol 7**.

ALS

4. Establish IV access, preferably in the antecubital fossa site.

5. Follow the most appropriate ACLS algorithm according to rhythm presented and consider the potential etiology of the arrest.

Top

6. Transport to the closest, most appropriate OB facility.

   a) Continue resuscitation efforts.

   b) Contact the receiving hospital's OB facility to prepare for the consideration of peri-mortem cesarean delivery.

N. Traumatic Arrest

EMR/BLS

1. Begin cardiopulmonary resuscitation as outlined in **Section B**.

   a) Resuscitation efforts can be terminated if the patient meets criteria outlined in **Protocol 27**.

2. Perform airway management **Protocol 7**.

3. Simultaneous interventions:

   a) Hemorrhage Control as necessary **Protocol 21**.

ALS

   b) If suspected pneumothorax, perform bilateral needle decompression **Procedure 5**, beginning on the most injured side first.

   c) Establish at least two large-bore IVs. **Do not delay transport to secure IV access.**

   d) Administer Tranexamic Acid (TXA)

   e) Administer a **fluid bolus up to 1000 mL of NS**.

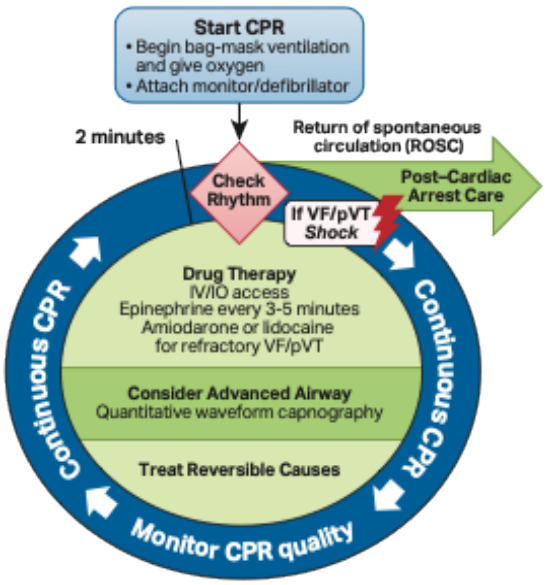
4. Follow the most appropriate ACLS algorithm according to rhythm presented and consider the potential etiology of the arrest.

5. If ROSC is achieved, follow **Section L**.

6. Transport to the closest Trauma Center, advise the receiving facility of ROSC and the field administration of 2 grams of TXA.

Top

Adult Cardiac Arrest Circular Algorithm



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, 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 $ETCO_2$ 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

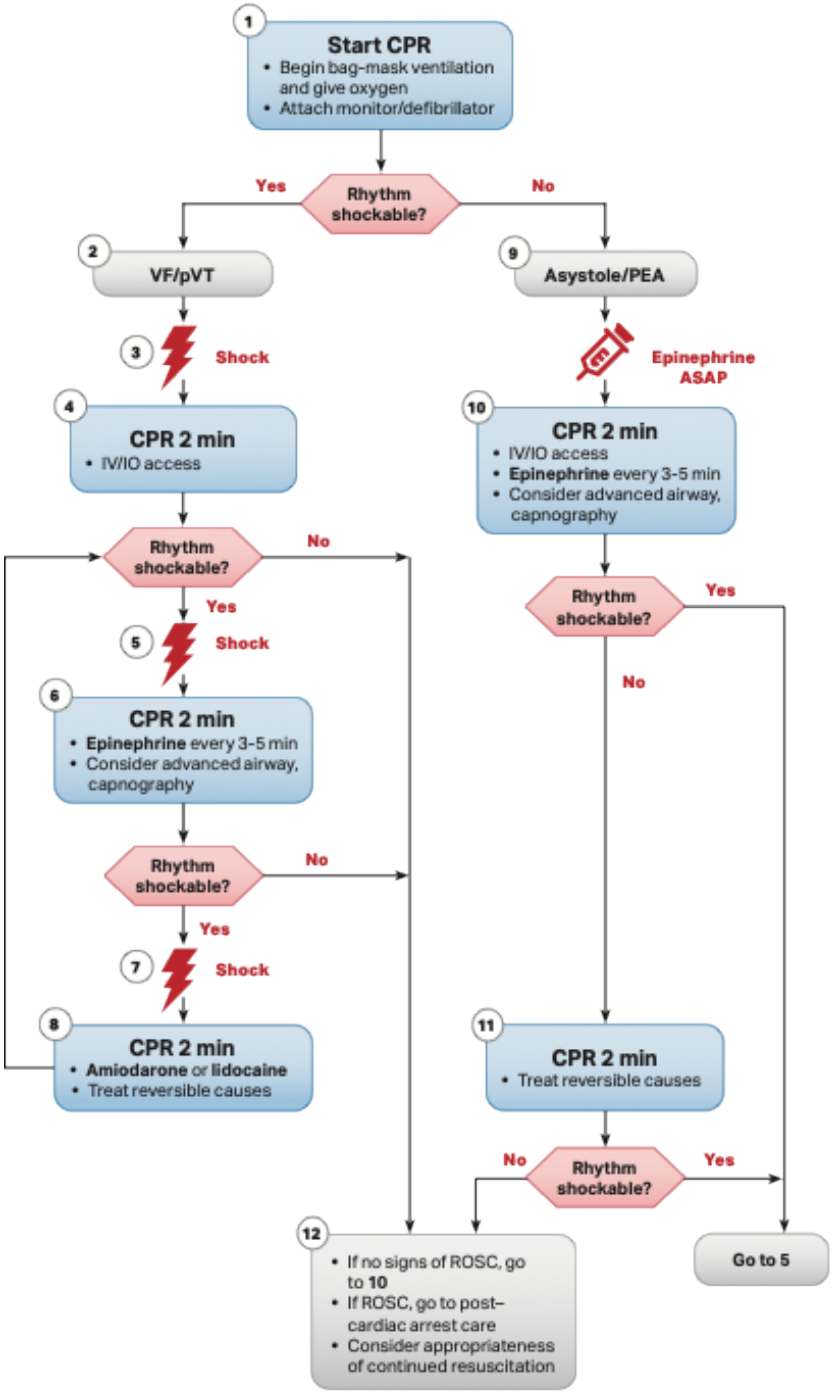
- ET intubation or supraglottic advanced airway
- Continuous waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Reversible Causes

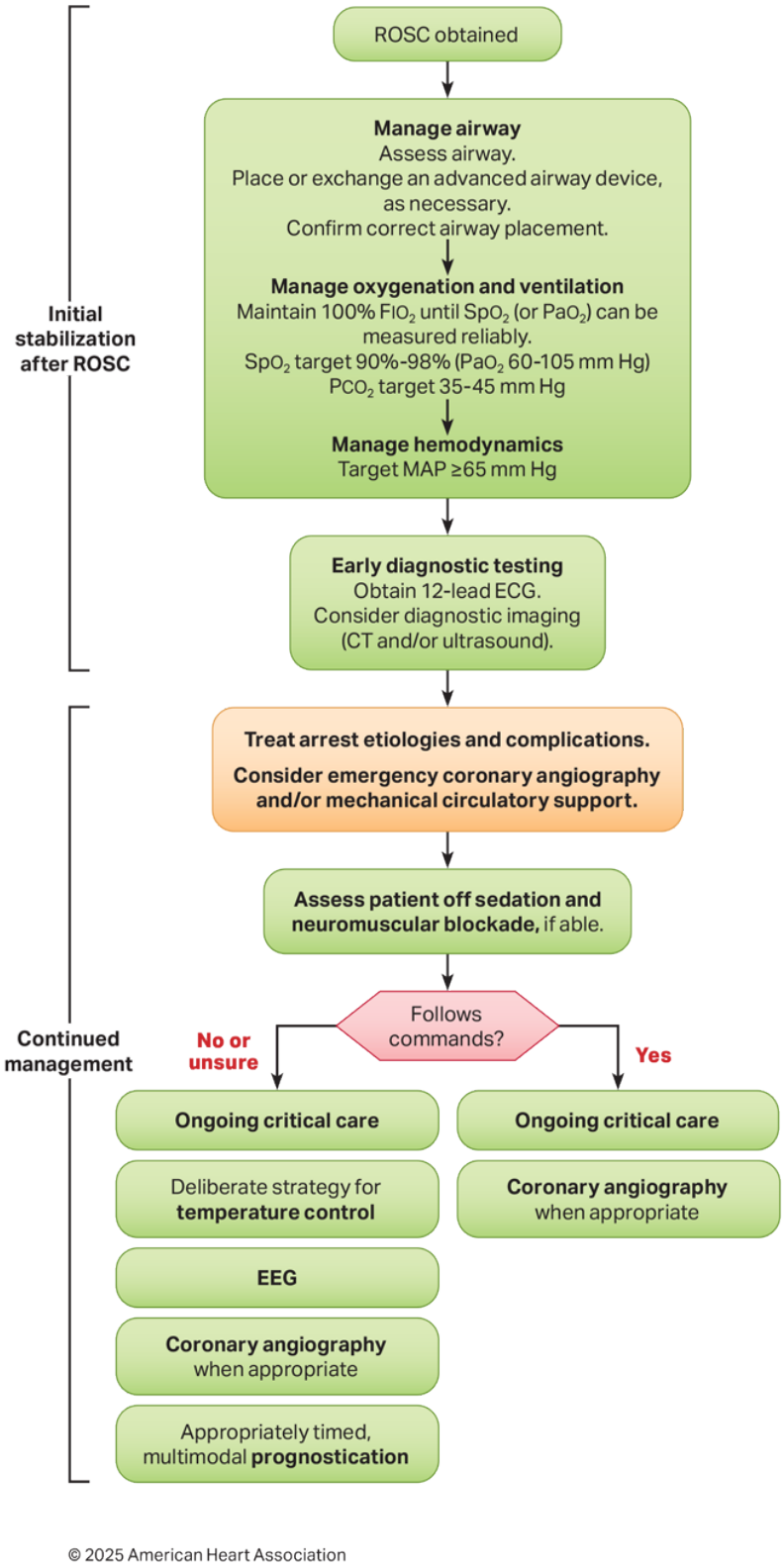
- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Top

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



Top



Initial Stabilization After ROSC

Resuscitation is ongoing during the post-ROSC phase, and many of these activities can occur concurrently.

Manage airway: Assess and consider placement or exchange of an advanced airway device (usually endotracheal tube or supraglottic device). Confirm correct placement of an advanced airway. This generally includes the use of waveform capnography or capnometry.

Manage oxygenation and ventilation: Titrate FIO_2 for SpO_2 90%-98% (or PaO_2 60-105 mm Hg). Adjust minute ventilation to target PCO_2 35-45 mm Hg in the absence of severe acidemia.

Manage hemodynamics: Initiate or adjust vasopressors and/or fluid resuscitation as necessary for goal MAP ≥65 mm Hg.

Early diagnostic testing: Obtain 12-lead ECG to assess for ischemia or arrhythmia. Consider CT head, chest, abdomen, and/or pelvis to determine cause of arrest or assess for injuries sustained during resuscitation. Point-of-care ultrasound or echocardiography may be reasonable to identify clinically significant diagnoses requiring intervention.

Continued Management

Treat arrest etiologies and complications.

Consider emergency cardiac intervention:

- Persistent ST-segment elevation present
- Cardiogenic shock
- Recurrent or refractory ventricular arrhythmias
- Severe myocardial ischemia

Temperature control: If patient is not following commands off sedation and neuromuscular blockade or is unable to assess, initiate a deliberate strategy of temperature control with goal 32 °C-37.5 °C as soon as possible.

Evaluate for seizure: Evaluate for clinical seizure and obtain EEG to evaluate for seizure in patients not following commands.

Prognostication: Multimodal approach with delayed impressions (≥72 hours from ROSC or achieving normothermia).

Ongoing critical care includes the following:

- Target PaO_2 60-105 mm Hg, PCO_2 35-45 mm Hg (unless severe acidemia); avoid hypoglycemia (glucose <70 mg/dL) and hyperglycemia (glucose >180 mg/dL); target MAP ≥65 mm Hg.
- Consider antibiotics.