The following protocol is intended for the systematic treatment of common cardiac dysrhythmia and cardiac arrest scenarios. The “pit crew approach” will be utilized by all personnel when providing resuscitation as outlined in this protocol.

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 is the top priority 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 and simultaneously checking for a pulse.

2. If no pulse, perform 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. 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 is in place, provide continuous compressions at a rate of at least 100 to 120/min and ventilate the patient once every 6 seconds.

6. High quality chest compressions are achieved when the ETCO2 value is at least 10-20 mmHg.

All cardiac arrests will be worked for at least 20 minutes on scene prior to the transportation of the patient to definitive care.
B. Cardiopulmonary Resuscitation

**EMR/BLS**

1. Initial Assessment [Protocol 1](#).
   
   a) Assess for responsiveness.
   
   b) Simultaneously look for no breathing or occasional gasps and check for a pulse, in an effort 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) Provide rescue breaths once every 5-6 seconds. Reassess for a pulse every 2 minutes.

3. If the patient has no pulse:
   
   a) Perform 200 chest compressions (2 minutes) with passive ventilations only.

   *Insert an oral and/or nasopharyngeal airway and apply a non-rebreather mask at 15L/min. Only passive ventilations will be provided during these first 2 minutes.*

   The Lucas Chest Compression device may be considered for prolonged resuscitation events after the initial 200 compressions have been delivered [Procedure 26](#).

   b) After the first 2 minutes continue with 30 compressions and 2 ventilations for 5 cycles of CPR.

4. Attach the AED patches as soon as possible:
   
   a) Allow the AED to analyze the patient’s rhythm and if shockable, deliver shock as soon as possible.
   
   b) Leave the AED on the patient and turned on throughout the resuscitation effort.
   
   c) The AED will prompt reassessment of a pulse and rhythm analysis every 2 minutes.
   
   d) If a shock is advised, minimize interruptions in chest compressions before and after shock.
   
   e) Resume CPR beginning with chest compressions immediately after each shock.
EMR/BLS CPR (With AED)

Unresponsive

Call for appropriate resources
(Rescue or suppression for manpower)

Check breathing and Pulse Simultaneously
(<10 seconds)

Has Pulse

Give 1 breath every 6 seconds
Check pulse every 2 minutes

No Pulse

Begin 200 uninterrupted compressions with passive ventilations

Apply AED/Defibrillator pads as soon as possible

Analyze rhythm

Shockable Rhythm?

Shockable

Give 1 shock
Resume CPR immediately for 2 minutes

Non-shockable

Resume CPR immediately for 2 minutes
Check rhythm every 2 minutes
Continue until ALS arrives

High Quality CPR
- Rate 100 to 120/min
- Depth of 2" to 2.4" inches
- Do not "lean on the chest" allow for complete chest recoil
- Minimize interruptions to <10 seconds
- Avoid excessive ventilations

Advanced Airway
After placement of an advanced airway compress the chest at a rate of 100 to 120/min and ventilate at a rate of one breath every 6 seconds without pauses in-between compressions and breaths

Passive Ventilations
Insert an oral/nasal airway and apply a NRB mask at 15L/min

AED/Defibrillator Analyze
Apply pads as soon as possible and deliver shock, if indicated.
1. Attach and turn on the Monitor / Defibrillator
   a) Apply the defibrillator pads and switch the monitor to “paddles.”
   b) Analyze for a shockable rhythm:
      a. Ventricular Fibrillation (V-Fib or VF)
      b. Pulseless Ventricular Tachycardia (Monomorphic V-Tach or VT)
      c. Torsades De Pointes or Polymorphic VT
   c) If the patient presents with a shockable rhythm, deliver shock as soon as possible.
      a. Defibrillate at 360 joules every 2 minutes as needed.
      b. Resume CPR beginning with chest compressions immediately after each shock, 30 compressions 2 breaths for 5 cycles (2 minutes).
         (Consider the Lucas Chest Compression device once available and manual chest compressions should be continued during the placement of compression device.)
   d) If the patient does not present with a shockable rhythm: Resume CPR beginning with chest compressions after each reassessment.
   e) Reassessment shall be done after every 2 minutes of CPR, simultaneously checking for a pulse and confirming the underlying rhythm.
2. Establish vascular access via IV or IO as soon as possible without delaying chest compressions.
   a) Deliver medications in accordance with the rhythm-based protocol the patient is being treated under the proceeding sections in this protocol.
3. Secure an advanced airway Protocol 07 as soon as possible without delaying chest compressions.
4. For patients with trauma to the torso that are in traumatic cardiac arrest, perform bilateral needle decompression Procedure 5. This is done to ensure there is no tension pneumothorax as the cause of cardiac arrest.
5. Attach and monitor End Tidal CO₂ and waveform capnography Procedure 11.
C. Ventricular Fibrillation/Pulseless Ventricular Tachycardia (VF/pVT)

For a patient in VF/pVT, initially perform 200 uninterrupted chest compressions. Establish IV / IO access as soon as possible.

1. **Defibrillate at 360 joules** and repeat defibrillation every 2 minutes, if rhythm shockable.
2. Administer **Epinephrine, 1 mg**. IV/IO push, circulate with 2 minutes of CPR.
3. **Defibrillate at 360 joules**, if rhythm shockable. Resume CPR.
4. Administer **Amiodarone 300 mg**, IV/IO push, circulate with 2 minutes of CPR.
5. **Defibrillate at 360 joules**, if rhythm shockable. Resume CPR.

*Consider an advanced airway, capnography (ETT or i-Gel).*

6. Administer **Epinephrine, 1 mg** IV/IO push, circulate with 2 minutes of CPR.
7. **Defibrillate at 360 joules**, if rhythm shockable. Resume CPR.
8. Administer **Amiodarone 150 mg** IV/IO push, circulate with 2 minutes of CPR.
9. **Defibrillate at 360 joules**, if rhythm shockable. Resume CPR.
10. Administer **Epinephrine, 1 mg** IV/IO push, circulate with 2 minutes of CPR.
11. **Defibrillate at 360 joules**, if rhythm shockable. Resume CPR.
12. If the rhythm fails to convert, continue CPR with Epinephrine IV/IO every 3-5 minutes and defibrillation as needed.

   a. At any time consider underlying causes and manage as indicated in “Potentially Reversible Causes in Cardiac Arrest” (H’s and T’s) in Section E.

   b. After 20 minutes additional antiarrhythmics such as **Lidocaine 1 mg/kg (Up to a max of 3 mg/kg)** may be considered if the patient remains in refractory VF or pulseless VT.

13. If patient is in polymorphic ventricular tachycardia (Torsades de Pointes). **Magnesium Sulfate 2 gm IV/IO over 1-2 minutes** may be given at any time after the first epinephrine.
14. After ROSC, refer to the Post Resuscitative Care Protocol, Section L.
Ventricular Fibrillation / Pulseless Ventricular Tachycardia

If after 20 minutes patient remains in VF/pVT, consider **Lidocaine 1 mg/kg**
(Up to a max of 3 mg/kg)
If Torsades, administer Magnesium Sulfate 2 gm over 1-2 min
After ROSC maintain B/P ≥ 90 mmHg and perform post resuscitative care.
D. Asystole

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

1. Perform CPR.

2. Establish TWO IV/IO lines as soon as possible.

3. Administer Epinephrine 1 mg IV/IO every 3 Minutes.

4. Administer Calcium Chloride, 1 gm (1000 mg) IV/IO SLOWLY over 1 minute.

5. Consider underlying causes and manage as indicated in “Potentially Reversible Causes in Cardiac Arrest” (H's and T's) in Section E.

6. Administer Sodium Bicarbonate 1 mEq/kg IV/IO in cases of preexisting metabolic acidosis is suspected such as in near drowning, renal dialysis, or DKA patients.*

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

1. Perform CPR.

2. Administer Epinephrine 1 mg 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).

<table>
<thead>
<tr>
<th>Potentially Reversible Causes in Cardiac Arrest (H’s and T’s)</th>
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<tbody>
<tr>
<td><strong>Hypovolemia</strong></td>
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<td><strong>Hypoxemia</strong></td>
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<td><strong>Hydrogen-ions (Acidosis)</strong></td>
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<td><strong>Hypoglycemia</strong></td>
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<td><strong>Tension Pneumothorax</strong></td>
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<td><strong>Tamponade, Cardiac</strong></td>
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<tr>
<td>(Toxin): Beta Blocker OD</td>
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<tr>
<td>(Toxin): Calcium Channel Blocker OD</td>
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F. Wide Complex Tachycardia – Regular (Monomorphic) with a Pulse

**UNSTABLE - Patient presents with CP, AMS, SOB, and/or HYPOTENSION BP < 90 mmHg**

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 each energy delivery:
   a) 100 joules
   b) 200 joules
   c) 300 joules
   d) 360 joules

3. If no conversion, consider **Amiodarone 150 mg IV over 10 minutes**.

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 with a fluid bolus of up to 1000 mL. If fluids are unsuccessful administer **Dopamine 10 mcg/kg/minute**. Monitor patient's B/P and lung sounds often.

**STABLE PATIENT**

1. 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 gtt/min may be repeated every 10 minutes.

2. 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**.
Wide Complex Tachycardia with a Pulse

Initial Assessment
Protocol 1

STABLE

- Regular or Irregular?
  - Regular (VT)
    - Amiodarone 150 mg IV over 10 minutes
    - Convert
      - YES
      - Transport with supportive care
      - NO
      - Amiodarone 150 mg IV over 10 minutes
  - Irregular
    - Go to Section G.

UNSTABLE

- Sedate with Versed if time allows
- Cardiovert
  - 100 J - 200 J - 300 J - 360 J
- Rhythm Converts
  - B/P < 90?
    - Fluid Challenge
      - B/P < 90?
        - Fluid Challenge
          - B/P < 90?
            - Dopamine or Epi Drip

G. Torsades de Pointe – Irregular (Polymorphic VT)

Polymorphic (irregular) VT requires immediate defibrillation with the same protocol for VF. For polymorphic VTs, due to the QRS complex appearance, it will be virtually impossible for cardiac monitors for synchronization. Although some patients may present with a pulse, it typically will deteriorate quickly to a pulseless VT.

UNSTABLE - Patient presents with CP, AMS, SOB, and/or HYPOTENSION BP < 90 mmHg

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 is converted:
   a) 360 joules

3. If no conversion, consider Magnesium Sulfate 2 gm IV over 2 minutes.

4. If the rhythm fails to convert, continue Defibrillation 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 with a fluid bolus of up to 1000 mL. If fluids are unsuccessful, administer Dopamine 10 mcg/kg/minute. Monitor patient's B/P and lung sounds often.

STABLE PATIENT

1. Administer Magnesium Sulfate 2 gm IV over 8-9 minutes. Mix 2 gm (4 mL) into a 50 mL NS bag with a 10 gtt/mL set and run at 60 gtt/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.
Wide Complex Tachycardia Irregular (Polymorphic) with a Pulse

Initial Assessment
Protocol 1

STABLE

Regular or Irregular?

Regular (VT)

Go to Section F.

Irregular

Magnesium Sulfate 2 gm IV over 10 minutes

UNSTABLE

Sedate with Versed if time allows
Defibrillate 360 J
Reassess

Rhythm Converts B/P < 90?

Fluid Challenge

B/P < 90?

Dopamine or Epi Drip

Seek expert consultation. If patient’s condition deteriorates, Go to Section C.

Seek expert consultation. If patient’s condition deteriorates, Go to Section C.

Transport with supportive care

YES

Convert

NO

Seek expert consultation. If patient’s condition deteriorates, Go to Section C.
H. Narrow Complex Tachycardia (HR ≥ 150) 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 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 to a cardiac event. Therefore, a focused initial assessment of the patient is crucial to determine the underlying cause prior to any treatment or intervention.

**UNSTABLE - Patient presents with CP, AMS, SOB, and/or HYPOTENSION BP < 90 mmHg**

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

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 Cardiopulmonary Resuscitation, **Section B** and follow most appropriate algorithm for the rhythm presented.

6. After successful conversion maintain O2 saturation ≥ 94% and treat hypotension if BP is < 90 mmHg with fluids (up to 1000 mL NS IV) and possibly Dopamine (10 mcg/kg/min).
STABLE PATIENT – Narrow Complex Tachycardia (HR ≥ 150) with a Pulse

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

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.

   **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 and follow most appropriate algorithm for the rhythm presented.
Narrow Complex Tachycardia

Initial Assessment **Protocol 1**

**STABLE**
- Regular or Irregular?
  - Regular (PSVT)
    - Vagal Maneuvers
      - Adenosine 6 mg Rapid IVP
        - Convert?
          - YES
            - Go to **Section I.**
          - NO
            - Adenosine 12 mg Rapid IVP
              - Convert?
                - YES
                - NO

**UNSTABLE**
- Sedate with **Versed** if time allows
  - Cardiovert 100 J - 200 J - 300 J - 360 J
  - Rhythm Converts B/P < 90?
    - Fluid Challenge
      - B/P < 90?
        - Fluid Challenge
          - Dopamine

Diltiazem 0.25 mg/kg to a max of 20 mg total. If no conversion may repeat after 15 minutes at 0.35 mg/kg to a max dose of 25 mg
I. Atrial Fibrillation/Atrial Flutter

Patients in atrial fibrillation/flutter with a rapid ventricular rate \( \geq 150 \text{ bpm} \).

1. Oxygen to maintain a saturation of \( \geq 94\% \).
2. Start an IV of Normal Saline.

STABLE PATIENT

3. Administer Diltiazem \( 0.25 \text{ mg/kg slow IV push over 2 minutes} \) (MAX 20 mg).

   If no conversion after 15 minutes:

4. Diltiazem \( 0.35 \text{ mg/kg slow IV push over 2 minutes} \) (MAX 25 mg).

UNSTABLE - Patient presents with CP, AMS, SOB, and/or HYPOTENSION BP < 90 mmHg

MCP

1. 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. 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 (PVC's)

1. If the patient is having significant PVC's, without SOB, administer Oxygen to maintain a saturation \( \geq 94\% \).
   a) Significant (Malignant) PVC's:
      Closely coupled (R on T), multiformal in configuration, occurring in short bursts of two or more in succession or runs of ventricular tachycardia.

2. Administer Amiodarone 150 mg IV over 10 minutes.

3. If the PVC's re-occur administer a second dose of Amiodarone 150 mg IV over 10 minutes and initiate transport to the closest appropriate hospital with supportive care enroute.

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

Symptomatic bradycardia is generally a heart rate less than 50/min that elicits signs and symptoms of CP, AMS, SOB, and/or poor or inadequate perfusion. Generally, a bradycardia rate is defined as a heart rate less than 60/min.

STABLE - Patient is NOT hypotensive

1. Monitor the patient, treat signs and symptoms and transport.

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

UNSTABLE - Patient presents with CP, AMS, SOB, and/or HYPOTENSION BP < 90 mmHg

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

1. Administer **Atropine, 0.5 mg** IV. This may be repeated every 3-5 minutes until the maximum dose of 3 mg is reached.

2. If Atropine is unsuccessful, begin **External Pacing (TCP)**, [Procedure 23](#).
   a) If conscious and BP > 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 < 90 mmHg give a **fluid bolus up to 1000 mL**. Monitor B/P and lung sounds often.
   c) If BP remains < 90 mmHg administer a **Dopamine Infusion 10 mcg/kg/minute and titrate to a blood pressure of 90-100 mmHg systolic**. [Appendix 9.1](#)

3. **Dopamine Infusion**, 10 mcg/kg/minute if TCP is unavailable or its use is unsuccessful (no capture).

4. If no change after max dose of Dopamine, **Epinephrine Infusion 2-10 mcg/min (titrated to effect)** [Appendix 9.2](#). Mix Epinephrine 1:1,000 5 mg (5 mL) into a 500 mL NS bag with a 60 gtt/mL set to yield a concentration of 10 mcg/mL and begin administration at 1 drop every 4 seconds and titrate to desired effect.
Symptomatic Bradycardia

Initial Assessment Protocol 1

Assess and treat underlying causes:
Maintain Airway (Protocol 7) and administer Oxygen Procedure 1
Perform Rhythm strip and 12-Lead ECG (R/O AMI) but do not delay treatment for unstable patients.

Patient Stable?

STABLE

Monitor patient and treat signs and symptoms

UNSTABLE

Atropine
0.5 mg IVP
(May repeat after 3-5 Minutes)
DO NOT administer Atropine to patients with:
2° Type 2 – or - 3° AV blocks
If these rhythms are present, go to External Pacing

Atropine successful?

YES

Monitor patient and treat signs and symptoms

NO

Sedate if time allows

Pacing Procedure 23

If B/P < 90 systolic: NS Bolus
If B/P still < 90 systolic: Dopamine/Epi Drip
L. Post Resuscitation Care (ROSC)

1. Optimize ventilation and oxygenation
   
   a) Maintain oxygen saturation ≥ 94% to avoid potential oxygen toxicity due to excessive ventilation, titrate to a target ETCO2 35-40 mmHg.

   b) 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 < 80 mg/dL administer D10 10 grams (100 mL) IV/IO.

2. If blood pressure is < 90 mm Hg 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 Dopamine. Clinical judgment should be utilized in determining when to proceed to Dopamine.

   b) Dopamine Infusion at 10 mcg/kg/minute and titrate to a blood pressure of 90-100 mmHg systolic. Appendix 9.1

   c) Epinephrine Infusion at 0.1-0.5 mcg/kg/min (e.g. 70 kg adult, 7-35 mcg/min.)

   Appendix 9.2 Mix Epinephrine 1:1,000 5 mg (5 mL) into a 500 mL NS bag with a 60 gtt/mL set to yield a concentration of 10 mcg/mL and begin administration at 1 drop every 2 seconds and titrate to desired effect.

   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. 12-Lead EKG. If STEMI, treat and transport per Protocol 11 ST Elevation Myocardial Injury/STEMI.

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

Coronary angiography is reasonable in post-cardiac arrest patients for whom coronary angiography is indicated regardless of whether the patient is comatose or awake.