

# **Tab 800**

# **Cardiac Protocols**



**Lucas County Emergency Medical Services**  
**2144 Monroe Street**  
**Toledo, Ohio 43604**

**TAB 800  
CARDIAC PROTOCOLS  
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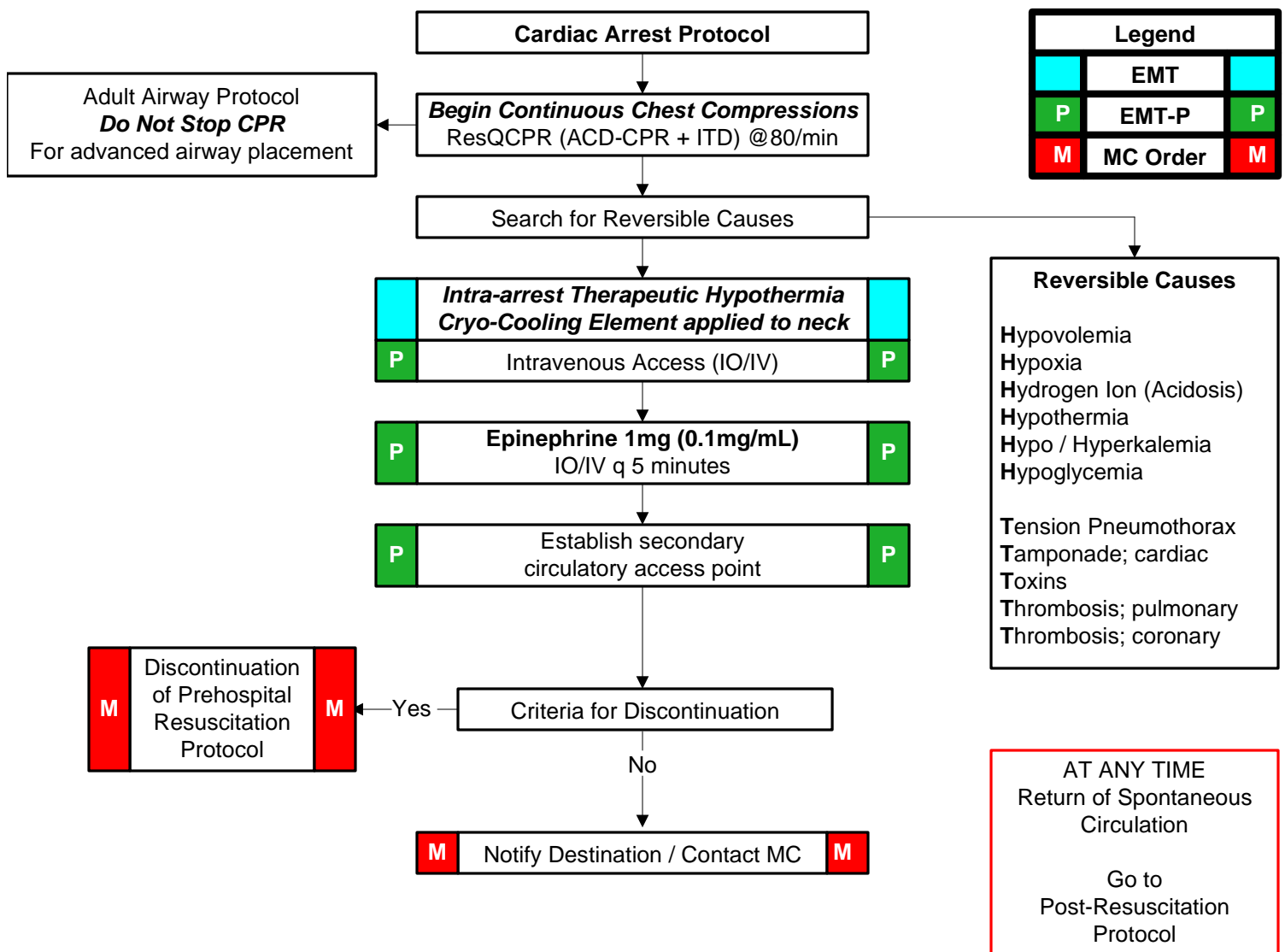
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# A Asystole



<b>History:</b> <ul style="list-style-type: none"> <li>• Past medical history</li> <li>• Medications</li> <li>• Events leading to arrest</li> <li>• ESRD</li> <li>• Estimated down time</li> <li>• Suspected hypothermia</li> <li>• Suspected overdose</li> <li>• DNR</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>• Pulseless</li> <li>• Apneic</li> <li>• No electrical activity on ECG</li> <li>• No auscultated heart tones</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>• Medical or Trauma</li> <li>• Hypoxia</li> <li>• Potassium (hypo/ hyper)</li> <li>• Drug overdose</li> <li>• Acidosis</li> <li>• Hypothermia</li> <li>• Device (lead) error</li> <li>• Death</li> </ul>
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# A Asystole



## Special Considerations:

1. Asystole is a cardiac arrest rhythm associated with no discernible electrical activity on the ECG.
2. For a patient with cardiac arrest and Asystole, quickly rule out any other causes of an isoelectric ECG such as:
  - Loose leads or leads not connected to the patient or defibrillator / monitor
  - No power
  - Signal gain (amplitude / signal strength) too low
3. Always confirm Asystole in more than one lead.
4. The management of Asystole consists of the following components:
  - Implementing the steps in the Cardiac Arrest Protocol
  - Identifying and correcting underlying causes
  - Terminating efforts as appropriate
5. Monitor patient's temperature and initiate intra-arrest induced hypothermia, unless contraindicated.
6. Several controlled trials failed to show benefit from attempted TCP for Asystole. TCP is not recommended for patients with asystolic cardiac arrest.
7. The decision to terminate resuscitative efforts rests with **On-Line Medical Control** and is based on consideration of many factors, including:
  - Time from collapse to CPR
  - Time from collapse to first defibrillation attempt (if necessary)
  - Comorbid disease
  - Prearrest state
  - Initial arrest rhythm
  - Response to resuscitative measures

None of these measures alone or in combination is clearly predictive of outcome. However, the duration of resuscitative efforts is an important factor associated with poor outcome. Sustained Asystole with no identifiable causes, and refractory to medication therapy should be considered for discontinuation when you determine with a high degree of certainty that the patient will not respond to further ACLS. Refer to the Discontinuation of Prehospital Resuscitation Policy (Tab 800: Section G.)

# A Asystole



Special Considerations (cont.),

**Potentially Reversible Causes of Asystole (H's):**

Condition	Clues From History And Physical Examination	Potential Effective Interventions
<b>Hypovolemia</b>	History, flat neck veins	Volume infusion
<b>Hypoxia</b>	Cyanosis, airway problems	Oxygenation, ventilation, Advanced airway
<b>Hydrogen ion (acidosis)</b>	History of diabetes, bicarbonate-responsive preexisting acidosis, renal failure	Ventilation, sodium bicarbonate
<b>Hyperkalemia</b>	History of renal failure, diabetes, recent dialysis, dialysis fistulas, medications	<i>Hyperkalemia:</i> <ul style="list-style-type: none"> <li>• Calcium Chloride</li> <li>• Sodium Bicarbonate</li> </ul>
<b>Hypokalemia</b>	Abnormal loss of potassium, diuretic use	<i>Hypokalemia:</i> Add magnesium if cardiac arrest
<b>Hypothermia</b>	History of exposure to cold, central body temperature	Hypothermia protocol

# A Asystole



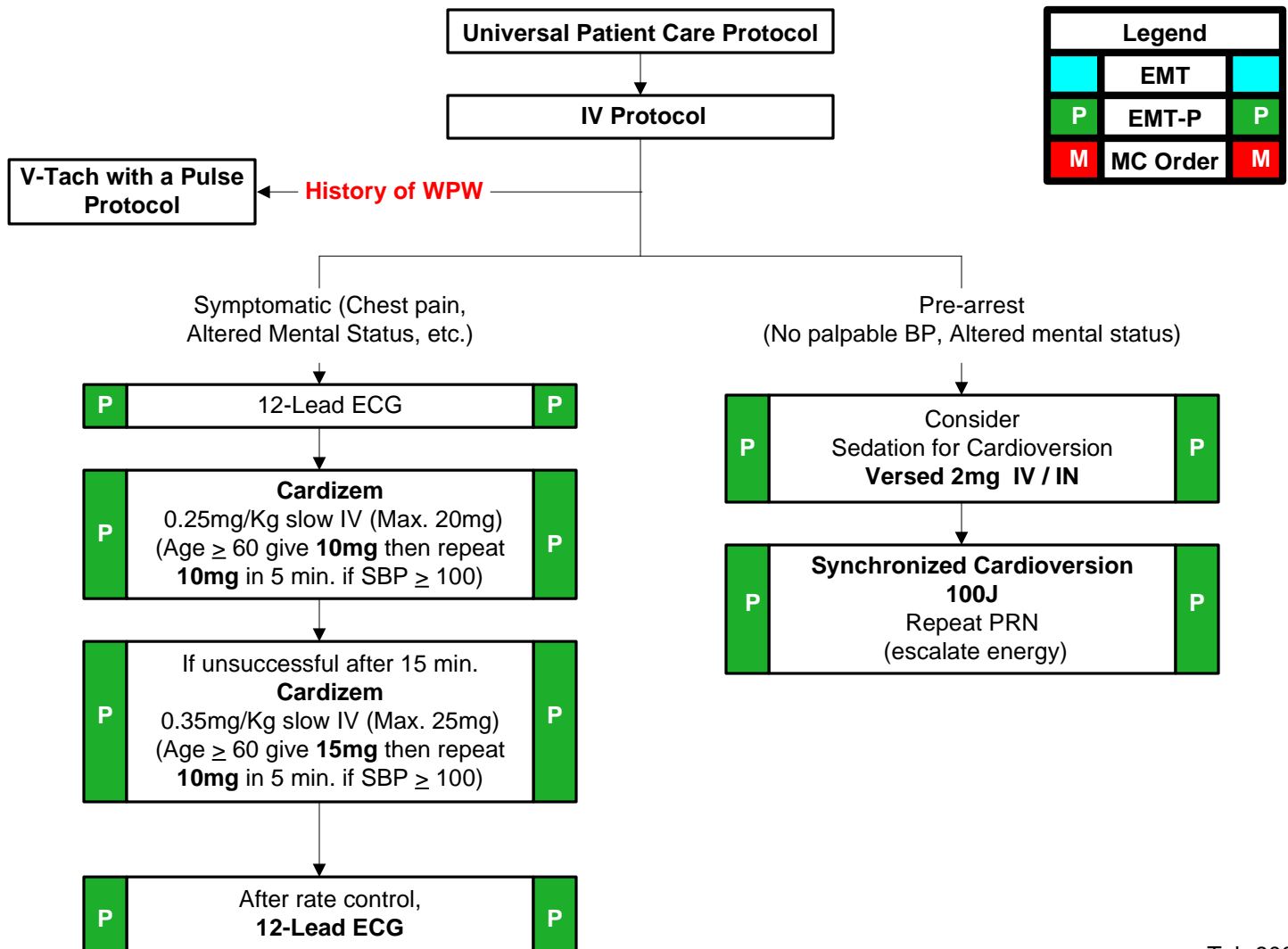
Special Considerations (cont.),

**Potentially Reversible Causes of Asystole (T's):**

Condition	Clues From History And Physical Examination	Potential Effective Interventions
<b>Tension Pneumothorax</b>	History, no pulse felt with CPR, neck vein distention, tracheal deviation, unequal breath sounds, difficult to ventilate patient	Needle decompression
<b>Tamponade, cardiac</b>	History, no pulse felt with CPR, vein distention	Pericardiocentesis
<b>Toxins (drug OD): Tricyclics, digoxin, β-Blockers, calcium channel blockers</b>	Initial bradycardia, empty bottles at the scene, pupils, neurologic exam	Intubation, specific antidotes and agents per toxidrome
<b>Thrombosis, lungs: Massive pulmonary embolism</b>	History, no pulse felt with CPR, distended neck veins, prior positive test for deep vein thrombosis or pulmonary embolism	Surgical embolectomy, fibrinolytics
<b>Thrombosis, heart: Massive MI</b>	History, cardiac markers, good pulse with CPR	

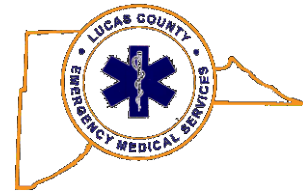


History:	Signs / Symptoms:	Differential:
<ul style="list-style-type: none"> <li>Medications                             <ul style="list-style-type: none"> <li>Aminophylline</li> <li>Diet pills</li> <li>Thyroid supplements</li> <li>Decongestants</li> <li>Digoxin</li> </ul> </li> <li>Diet (caffeine, chocolate)</li> <li>Drugs (nicotine, cocaine)</li> <li>Past medical history</li> <li>History of palpitations / heart racing</li> <li>Syncope / near-syncope</li> </ul>	<ul style="list-style-type: none"> <li>HR &gt; 160/min</li> <li>QRS &lt; 0.12 sec</li> <li><b>If history of WPW, go to V-Tach Protocol</b></li> <li>Dizziness, CP, SOB</li> <li>Potential presenting rhythm:                             <ul style="list-style-type: none"> <li>Sinus Tachycardia</li> <li>Atrial Fibrillation / Flutter</li> <li>Multifocal Atrial Tachycardia</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Heart disease (WPW, Valvular)</li> <li>Sick sinus syndrome</li> <li>Myocardial infarction</li> <li>Electrolyte imbalance</li> <li>Exertion, pain, emotional stress</li> <li>Fever</li> <li>Hypoxia</li> <li>Hyovolemia or anemia</li> <li>Drug effect / Overdose</li> <li>Hyperthyroidism</li> <li>Pulmonary embolus</li> </ul>



## B

# Atrial Fibrillation / Flutter



### Special Considerations:

1. This protocol applies to the patient who is symptomatic due to Atrial Fibrillation / Flutter.
2. Atrial Fib/Flutter can be caused by many underlying factors. Consider the following possible causes and, if verified, render the appropriate treatment:
  - Hypovolemia
  - Hypoxia
  - Hydrogen Ion (Acidosis)
  - Hyper/Hypokalemia
  - Hypothermia
  - Hypoglycemia
  - Toxins (poisons, overdose)
  - Tamponade, Cardiac
  - Tension Pneumothorax
  - Thrombosis, Coronary/Pulmonary
3. For symptomatic Atrial Fib/Flutter administer Cardizem 0.25mg/Kg (maximum dose 20mg) IV over 2 minutes (Age  $\geq$  60 give 10mg then repeat 10mg in 5 minutes if SBP  $\geq$  100). If needed, for further rate control, in 15 minutes give an IV dose of Cardizem at 0.35mg/Kg IV over 2 minutes (Age  $\geq$  60 give 15mg then repeat 10mg in 5 minutes if SBP  $\geq$  100).
4. If the patient develops an adverse reaction to Cardizem infusion (i.e., hypotension, bradycardia, heart-block), administer Calcium Chloride 1Gm over 5 minutes. Mix 1Gm of Calcium Chloride in a 50mL bag of D5W. With (10gtt) administration set, run at 100gtts/min. Continue Calcium Chloride drip until adverse symptoms resolve.
5. Unstable (pre-arrest) Atrial Fib/Flutter may require synchronized cardioversion starting at 100 Joules. Escalate as necessary for rhythm conversion (100J - 200J - 300J - 360J).





## B Atrial Fibrillation / Flutter



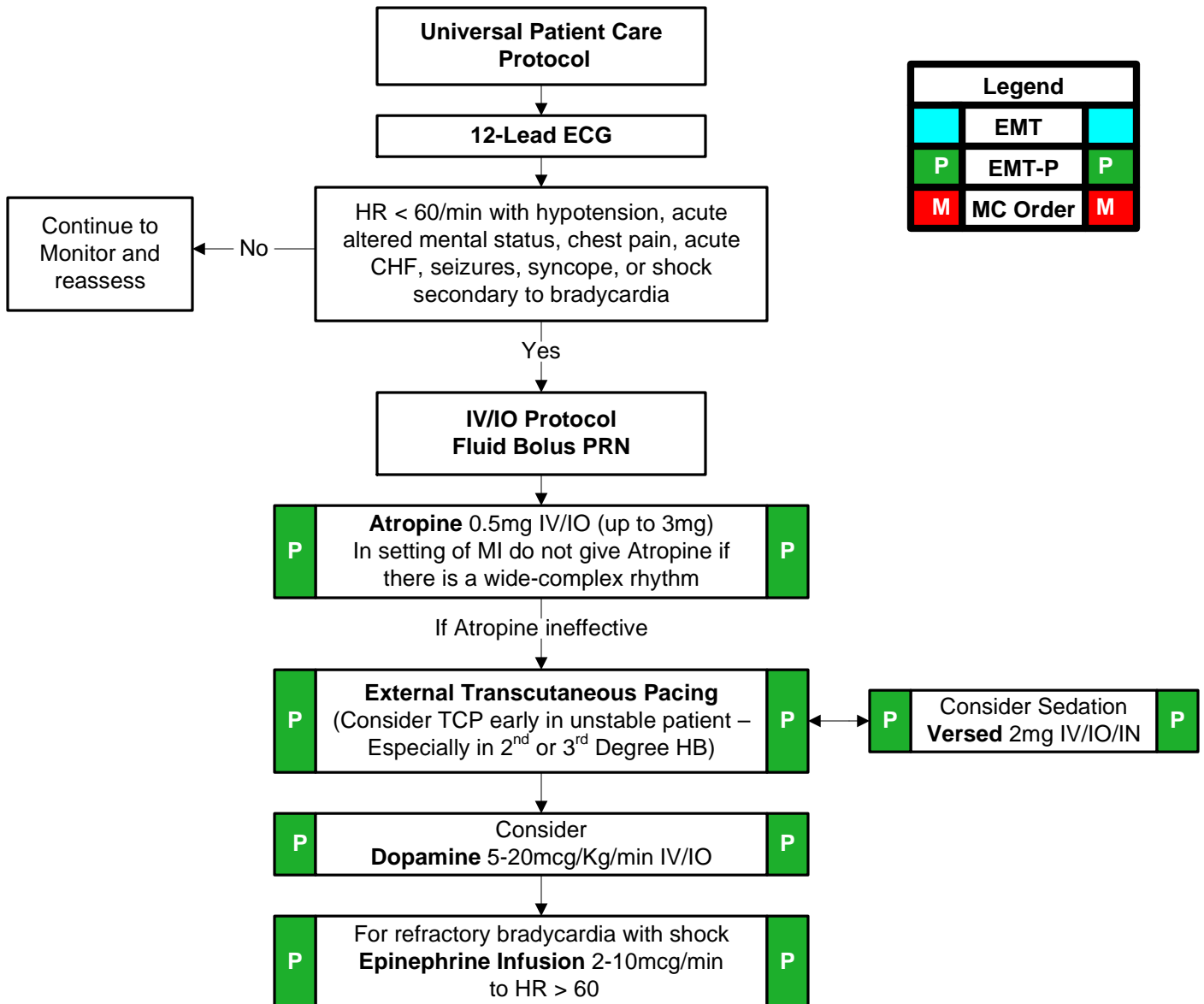
Special Considerations (cont.),

6. Patients requiring sedation prior to synchronized cardioversion should receive Versed 2mg slow IV. Absent IV access, consider administration of Versed 2mg IN.
  - If Versed allergy exists, consider analgesic administration as outlined in **Tab 900 Section T: Pain Management.**
7. If a known pre-excitation syndrome is identified by either ECG or patient history (i.e., Wolff-Parkinson-White Syndrome [WPW]), do not administer Cardizem. This may cause a paradoxical increase in the ventricular response to the rapid atrial impulses passing through an accessory AV pathway. ***If WPW is suspected, treat per the Ventricular Tachycardia/Wide Complex with a Pulse Protocol (Tab 800, Section Q).***

# C Bradycardia



<p><b>History:</b></p> <ul style="list-style-type: none"> <li>• Past medical history</li> <li>• Medications:             <ul style="list-style-type: none"> <li>• Beta Blockers</li> <li>• Calcium channel blockers</li> <li>• Clonidine</li> <li>• Digitalis</li> </ul> </li> <li>• Pacemaker</li> </ul>	<p><b>Signs / Symptoms:</b></p> <ul style="list-style-type: none"> <li>• HR &lt; 60/min</li> <li>• Chest pain</li> <li>• Respiratory Distress</li> <li>• Hypotension or shock</li> <li>• Altered Mental Status</li> <li>• Syncope</li> </ul>	<p><b>Differential:</b></p> <ul style="list-style-type: none"> <li>• Acute myocardial infarction</li> <li>• Hypoxia</li> <li>• Hypothermia</li> <li>• Sinus Bradycardia</li> <li>• Athletes</li> <li>• Head Injury (elevated ICP) or Stroke</li> <li>• Spinal cord lesion</li> <li>• Sick sinus syndrome</li> <li>• Junctional rhythms</li> <li>• AV Blocks (1st, 2nd, 3rd degree)</li> <li>• Overdose</li> </ul>
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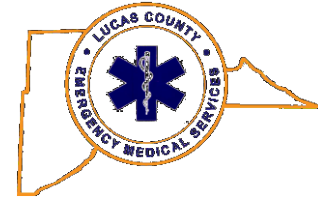
## C Bradycardia



### Special Considerations:

1. Bradycardia can be caused by many underlying factors. Possible causes should be considered and, if verified, the appropriate treatment administered:
  - a. Hypovolemia
  - b. Hypoxia
  - c. Hydrogen Ion (Acidosis)
  - d. Hyper/Hypokalemia
  - e. Hypothermia
  - f. Hypoglycemia
  - g. Toxins (Poisons, overdose)
  - h. Tamponade, Cardiac
  - i. Tension Pneumothorax
  - j. Thrombosis, Coronary/Pulmonary
2. Treatment of bradyarrhythmias may not be required if the patient is asymptomatic.
3. Hypoxemia, acidosis, and hypotension interfere with sinus node function and slow cardiac conduction. In addition, excessive vagal stimulation (i.e. suctioning) may produce bradycardia.
4. Transcutaneous pacing should be considered early in patients with severe hemodynamic compromise due to bradycardia. Atropine administration should not delay implementation of external pacing for patients with poor perfusion. Denervated transplanted hearts will not respond to Atropine and TCP is indicated as the initial intervention for symptomatic bradycardia.
5. Atropine is administered at 0.5mg IV. Repeat dosage every 3-5 minutes to achieve perfusing heart rate > 60bpm. The total adult vagolytic dose of Atropine is 3mg.
6. For severely symptomatic patients, and refractory to Atropine dosing, initiate transcutaneous pacing at 80bpm. Increase milliamperage until electrical capture is realized.

## C Bradycardia



### Special Considerations (cont.),

7. Patients requiring sedation prior to transcutaneous pacing should receive Versed 2mg slow IV. Absent IV access, consider administration of Versed 2mg IN.
  - If Versed allergy exists, consider analgesic administration as outlined in **Tab 900 Section T: Pain Management**.
8. Dopamine, if required, is administered at 5-20mcg/Kg/min. Mix 400mg of Dopamine in 250mL of D5W (1600mcg/mL). With mini-drip setting on administration set (60gtt), start Dopamine drip at 5mcg/Kg/min and titrate up to a maximum of 20mcg/Kg/min or until a perfusing heart rate and blood pressure are achieved.

**Dopamine Drip Rates:**

- 15gtts = 400mcg/min
- 30gtts = 800mcg/min
- 45gtts = 1200mcg/min
- 60gtts = 1600mcg/min

### **\*\*Quick Dopamine Drip Equation:**

Take patient weight in pounds and drop last number. Remaining value will be the drip rate for 5mcg/Kg/min. Double the number for 10mcg/Kg/min.

EX:

Pt Wt = 190lbs (drop the last number) = 19gtts for 5mcg/Kg/min  
38gtts for 10mcg/Kg/min



## C Bradycardia



Special Considerations (cont.),

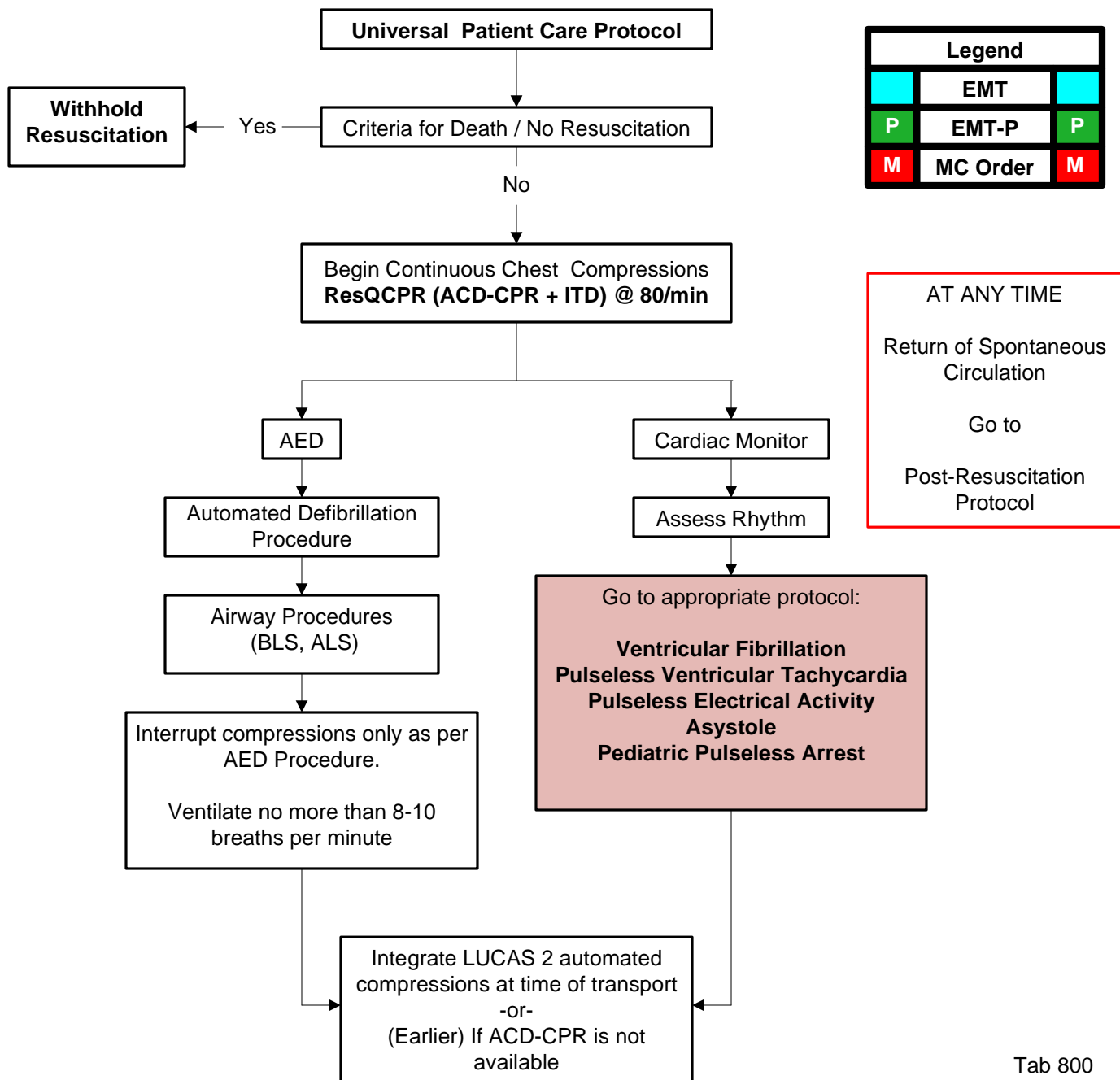
9. Epinephrine infusion, if required, is administered at 2-10mcg/min. Mix 2mg 1:1,000 Epinephrine in 250mL D5W (8mcg/mL). With mini-drip setting on administration set (60gtt), start Epinephrine drip at 2mcg/min and titrate up to a maximum of 10mcg/min or until a perfusing heart rate and blood pressure are achieved. A second IV line is desired, however do not delay administration of medication if not obtainable.

**Epinephrine Drip Rates:** 15gtts = 2mcg/min  
30gtts = 4mcg/min  
45gtts = 6mcg/min  
60gtts = 8mcg/min

# D Cardiac Arrest



<b>History:</b> <ul style="list-style-type: none"> <li>• Events leading to arrest</li> <li>• Estimated down time</li> <li>• Past medical history</li> <li>• Medications</li> <li>• Existence of terminal illness</li> <li>• Signs of lividity, rigor mortis</li> <li>• DNR</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>• Unresponsive</li> <li>• Apneic</li> <li>• Pulseless</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>• Medical vs. Trauma</li> <li>• VF vs. Pulseless VT</li> <li>• Asystole</li> <li>• Pulseless Electrical Activity (PEA)</li> </ul>
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## D Cardiac Arrest



### Special Considerations:

- A. Cardiac arrest is a life threatening condition and treatment should begin utilizing the appropriate approved protocol. Contact with **On-Line Medical Control** should occur when time permits to allow for early notification of patient assessment, treatments rendered in the field, and transport capabilities/decisions.
- B. Cardiac arrest as a result of significant trauma is not treated according to this protocol. Refer to the Traumatic Cardiac Arrest Protocol (Tab 800, Section O).
- C. Hypothermic arrest is not treated according to this protocol. Refer to the Hypothermic Cardiac Arrest Protocol (Tab 800, Section H).
- D. See Pediatric Protocols (Tab 1100) for special pediatric treatments.
- E. Aggressive, appropriate BLS and ALS interventions are necessary for improved survivability from cardiac arrest. With multiple responders, several treatments may be administered simultaneously. The on-scene "Paramedic" should make any necessary field assignments so that all resources are utilized to their fullest extent (i.e., CPR, ventilation control, patient packaging).
- F. Large peripheral veins (antecubital or external jugular) are preferred IV sites in cardiac arrest. 14-16ga catheters are optimal for peripheral vein cannulation. In the setting of peripheral collapse, multiple IV attempts should be abandoned and IO infusion be considered immediately.
- G. Begin intra-arrest therapeutic hypothermia (IATH) and temperature monitoring upon initiation of resuscitative efforts.
- H. The first paramedic(s) on scene should check effectiveness of ongoing CPR in progress. Pulselessness should also be checked as cardiac function may have returned after arrhythmia or vasovagal episode.
- I. Paramedics **must always** utilize waveform capnography as a standard adjunct to airway control when equipment is available.

## D Cardiac Arrest



### Special Considerations (cont.),

- J. If any underlying cause of arrest is suspected (i.e., hypothermia, diabetes, overdose), it would be appropriate to integrate those treatment protocols during the resuscitative process. Do not, however, delay administration of cardiac medications while integrating treatments from other protocols.
- K. If there is any evidence of trauma noted during the resuscitative process, consider appropriate spinal motion restriction (SMR) techniques.
- L. Upon placing and evaluating an advanced airway (ET, KING), it is **strongly recommended** that the patient's head be immobilized to maintain airway control.
- M. The AutoVent (ATV) can deliver consistent tidal volume (TV) and rate. Consider its use on a basic facemask or advanced airway for better ventilatory control. Set tidal volume at approximately 600mL (sufficient to produce chest rise).
- N. The ResQPOD (ITD) attached to a basic facemask and/or advanced airway improves hemodynamics during chest compressions and increases the likelihood of ROSC from a cardiac arrest state. ***ResQPOD use is mandated in cardiac arrest victims > 1 year of age.***
- O. The importance of efficient, high-quality CPR cannot be over emphasized. Deploy and utilize the ResQCPR System (ACD-CPR + ITD) during on-scene resuscitative efforts. Ensure continuous airtight seal when using the ResQPOD ITD on a basic face mask. The ResQPUMP compression rate is 80/min (use two-tone metronome and compression / decompression force guide on pump handle to help guide efforts). In a patient with an un-secured airway, engage the ResQPOD ventilation timing lights (10/min) and ventilate on the upstroke (decompression phase of chest compressions). Once an advanced airway is secured (ET, KING), the ResQPOD should be attached and ventilations continue at 10/min (with timing light). Care should be taken not to over ventilate the patient. **KEEP YOUR VENTILATIONS AT 10/MINUTE. INTERRUPTIONS IN COMPRESSIONS NEED TO BE KEPT TO A MINIMUM.**

The ResQCPR System (ACD-CPR + ITD) **MUST** be used (when available) during all on-scene resuscitative efforts for adult patients ( $\geq$  16 years of age). In the event you are unable to achieve a suction-seal with the ResQPUMP, revert to use of manual compressions and/or automated CPR with the LUCAS Device. In the event a decision is made to transport a patient with on-going resuscitative efforts, automated CPR (LUCAS 2) should be initiated just prior to transport.



## D Cardiac Arrest



### Special Considerations (cont.),

- P. Patients with ROSC in the field should be transported affixed to the LUCAS 2 automated CPR device in the event re-arrest occurs. This will diminish the work-effort and time needed for device setup in a moving vehicle. Use a scoop stretcher (when possible) to move patient attached to LUCAS 2. The curved LUCAS back-plate conforms very well with the scoop stretcher and will help facilitate transfer of the patient.
- Q. **ResQCPR is performed in 2 minute intervals to allow for rescuer change and minimizing rescuer fatigue. Consider pre-charging the Life Pak at 1:45 to utilize the rescuer switch at 2 minutes more efficiently for rhythm recognition and defibrillation (if necessary).**
- R. In the post-resuscitation scenario with return of spontaneous circulation (ROSC), a 12-Lead ECG should be acquired as time permits.

### Transport Considerations

1. Any adult ( $\geq 16$ ) cardiac arrest not related to trauma or hemorrhage should be triaged to the closest "STEMI" / "Hypothermia" Center. Upon notification, LCEMS Dispatch will determine the closest open facility, and assign med channel for MC contact.
2. "STEMI" / "Hypothermia" Centers include St. Lukes, St. Vincent Mercy Medical Center (SVMMC), The Toledo Hospital (TTH), The University of Toledo Medical Center (UTMC), and Mercy St. Anne.

### Special Patient Treatment Considerations:

- A. ESRD (End-Stage Renal Disease) patients with suspected hyperkalemia as potential cause of arrest:
  - I. VF, Asystolic, or PEA arrest
    - a. 1Gram Calcium slow IO/IV push
    - b. 50mEq Sodium Bicarbonate IO/IV push

## D Cardiac Arrest



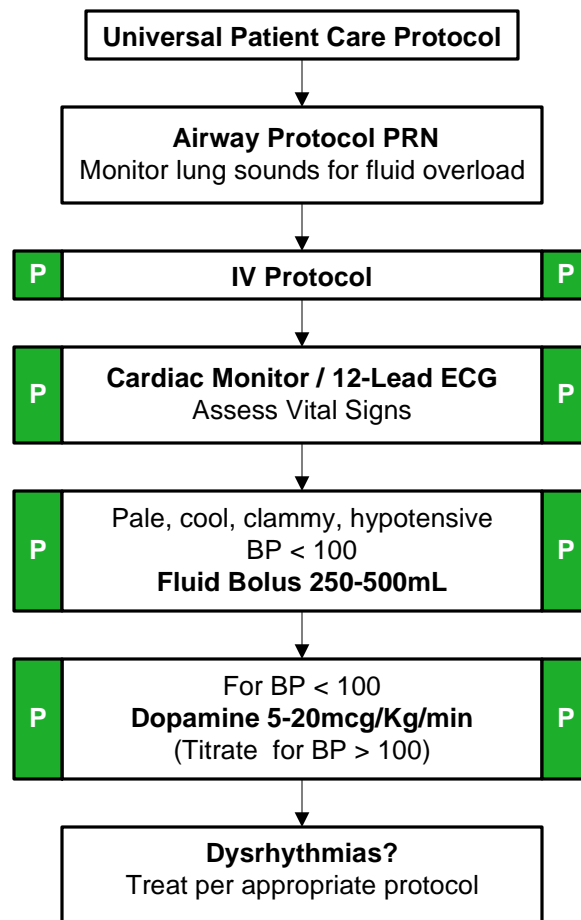
Special Considerations (cont.),

- B. Tricyclic Overdose as suspected cause of arrest:
  - I. VF, Asystolic, or PEA arrest
    - a. 1mEq/kg Sodium Bicarbonate IO/IV push
  
- C. Beta-Blocker Overdose as suspected cause of arrest:
  - I. VF, Asystolic, or PEA arrest
    - a. Glucagon 1mg (1 unit) IO/IV push
  
- D. Torsades de Pointes:
  - I. 2Grams Magnesium Sulfate IO/IV push
  
- E. Suspected narcotic overdose:
  - I. 4mg Narcan IO/IV

# E Cardiogenic Shock



<p><b>History:</b></p> <ul style="list-style-type: none"> <li>• Age</li> <li>• Medications</li> <li>• Past medical history (MI, Angina, Diabetes)</li> <li>• Allergies</li> <li>• Recent events</li> <li>• Onset</li> </ul>	<p><b>Signs / Symptoms:</b></p> <ul style="list-style-type: none"> <li>• Chest pain</li> <li>• Systolic BP &lt; 100</li> <li>• Rales or crackles ("wet" lung sounds)</li> <li>• Pedal edema</li> <li>• Dyspnea</li> <li>• Diaphoresis</li> <li>• Nausea / Vomiting</li> </ul>	<p><b>Differential:</b></p> <ul style="list-style-type: none"> <li>• Trauma vs. Medical</li> <li>• Myocardial infarction</li> <li>• Pulmonary embolism</li> <li>• Pneumothorax</li> <li>• Chest wall injury or pain</li> </ul>
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Legend		
	EMT	
P	EMT-P	P
M	MC Order	M

# E Cardiogenic Shock



## Special Considerations:

1. Hypotension and shock can be caused by volume, pump or rate problems. Infarction of  $\geq 40\%$  of the LV myocardium usually results in cardiogenic shock and carries a high mortality rate. Of those who develop shock, patients with ST-segment elevation develop shock significantly earlier than patients without ST-segment elevation.
2. Signs and symptoms of cardiogenic shock include:
  - a. Pain, heaviness, tightness or discomfort in the chest with hypotension (systolic BP  $< 100\text{mmHg}$ ).
  - b. Rales or crackles ("wet" lung sounds).
  - c. Pedal edema
  - d. Dyspnea
  - e. Diaphoresis
  - f. Nausea / Vomiting
3. Patients with a history of AMI or CHF have increased factors for the development of cardiogenic shock. Priorities include:
  - a. Assessing and securing the ABC's.
  - b. Determining the quality and severity of the patient's distress.
  - c. Identifying contributing factors of the event.
  - d. Obtaining a medical history (including medications and allergies).
4. Dopamine, if required, is administered at 5-20mcg/Kg/min. Mix 400mg of Dopamine in 250mL of D5W (1600mcg/mL). With mini-drip setting on administration set (60gtt), start Dopamine drip at 5mcg/Kg/min and titrate up to a maximum of 20mcg/Kg/min or until a perfusing heart rate and blood pressure are achieved.

**Dopamine Drip Rates:**

- 15gtts = 400mcg/min**
- 30gtts = 800mcg/min**
- 45gtts = 1200mcg/min**
- 60gtts = 1600mcg/min**

## **\*\*Quick Dopamine Drip Equation:**

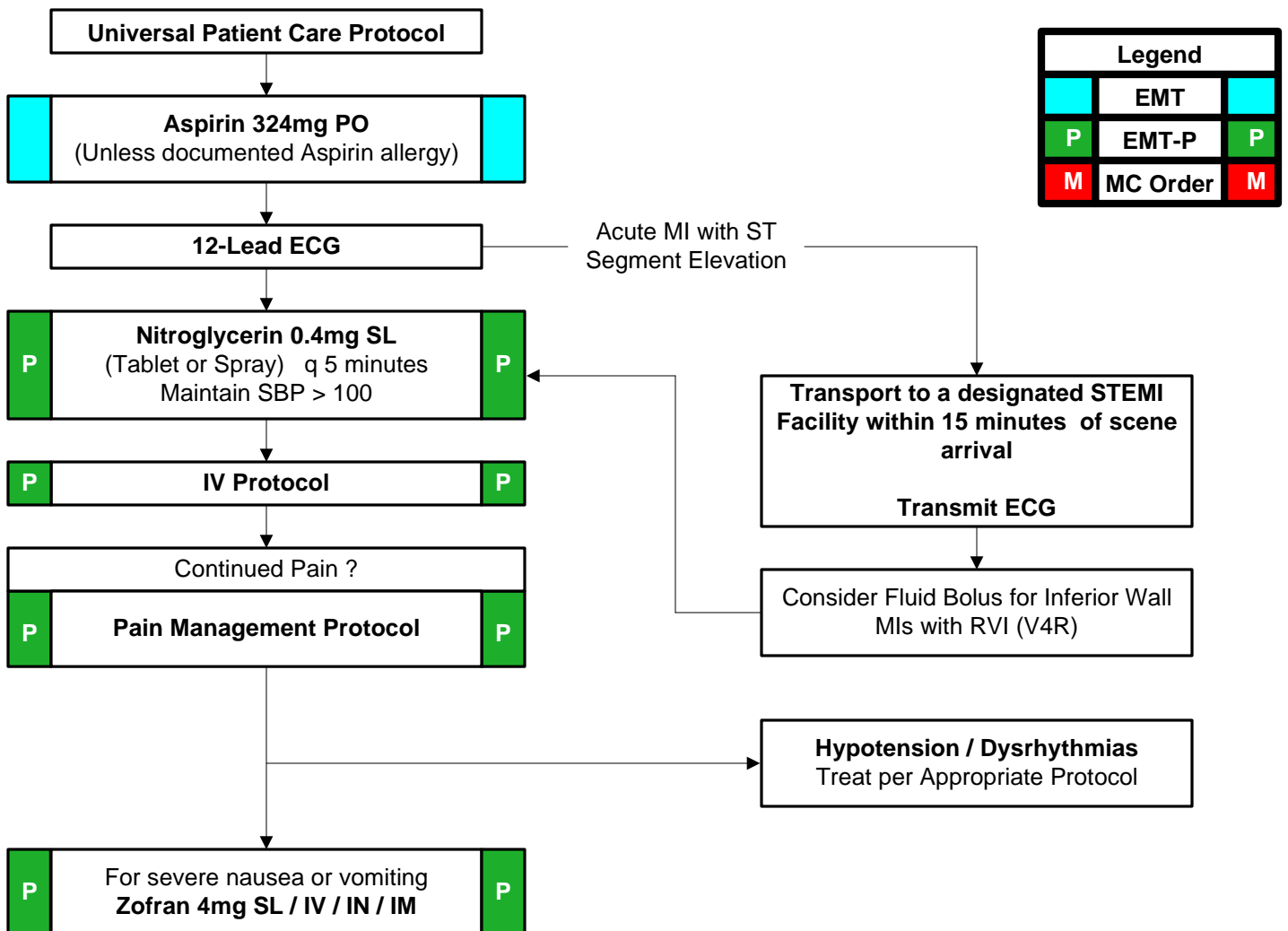
Take patient weight in pounds and drop last number. Remaining value will be the drip rate for 5mcg/Kg/min. Double the number for 10mcg/Kg/min.

EX: Pt Wt = 190lbs (drop the last number) = 19gtts for 5mcg/Kg/min  
38gtts for 10mcg/Kg/min

# F Chest Pain Acute Coronary Syndromes



<b>History:</b> <ul style="list-style-type: none"> <li>• Age</li> <li>• Medications</li> <li>• Viagra, Levitra, Cialis</li> <li>• Past medical history (MI, Angina, Diabetes, Post Menopausal)</li> <li>• Allergies</li> <li>• Recent physical exertion</li> <li>• Onset</li> <li>• Palliation / Provocation</li> <li>• Quality</li> <li>• Region / Radiation / Referred</li> <li>• Severity (1-10)</li> <li>• Time (duration / repetition)</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>• CP (pain, pressure, aching, vice-like tightness)</li> <li>• Location (substernal, epigastric, arm, jaw, neck, shoulder)</li> <li>• Radiation of pain</li> <li>• Pale, diaphoresis</li> <li>• Shortness of Breath</li> <li>• Nausea, vomiting, dizziness</li> <li>• Atypical presentations</li> <li>• Anginal equivalents</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>• Trauma vs. Medical</li> <li>• Angina vs. Myocardial Infarction</li> <li>• Pericarditis</li> <li>• Pulmonary embolism</li> <li>• Asthma / COPD</li> <li>• Pneumothorax</li> <li>• Aortic dissection or aneurysm</li> <li>• GI reflux or Hiatal hernia</li> <li>• Esophageal spasm</li> <li>• Chest wall injury or pain</li> <li>• Pleural pain</li> <li>• Overdose (Cocaine)</li> </ul>
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# F

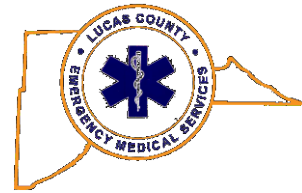
## Chest Pain Acute Coronary Syndromes



### Special Considerations:

1. Patients with coronary atherosclerosis may develop a spectrum of clinical syndromes representing varying degrees of coronary artery occlusion. These syndromes include unstable angina (UA), non-ST-segment elevation MI (NSTEMI) and ST-segment elevation MI (STEMI). Sudden cardiac death may occur with each of these syndromes.
2. Symptoms of myocardial ischemia and infarction vary greatly. Consider the following ACS descriptors:
  - a. **Classic Angina** – Retrosternal discomfort described as pressure or heaviness. Pain may radiate to the neck, jaw or bilateral arms. Classic angina may be associated with shortness of breath, palpitations, diaphoresis, nausea and vomiting.
  - b. **Anginal Equivalent** – No specified chest pain or discomfort. Patients present with sudden onset of difficulty breathing. Palpitations, syncope and pre-syncope also fall within this category.
  - c. **Atypical Chest Pain** – Chest pain that is described as sharp / stabbing which may have musculoskeletal or pleuritic features. Epigastric fullness or burning also falls into this category.
3. Evaluation of cardiac risk factors helps identify potential ACS patients. Risk factor evaluation should be included in the overall assessment of the patient. Patients with multiple risk factors for cardiovascular disease are more likely to be suffering from an acute coronary syndrome.
4. The 12-Lead ECG plays a major role in the clinical decision making process for ACS evaluation and treatment. ***With suspected ACS, a 12-Lead ECG should be acquired every 5-10 minutes, and with any change in patient condition.*** ECG changes indicative of ACS should be relayed to ***On-Line Medical Control*** and documented in the ePCR. When appropriate (STEMI), transmit the 12-Lead ECG to the receiving facility.

## F Chest Pain Acute Coronary Syndromes



### Special Considerations (cont.),

5. If the patient has not taken Aspirin (or Aspirin equivalent) and has no history of Aspirin allergy and no evidence of recent GI bleeding, **administer 324mg Aspirin PO**. In the initial hours of an ACS, Aspirin is absorbed better when chewed than when swallowed.
6. For cardiac-related chest pain and/or ECG changes indicative of myocardial ischemia, administer **Nitroglycerin 0.4mg SL (spray or tablet) every 5 minutes PRN. Maintain a blood pressure > 100mmHg**. For ECG changes suggestive of inferior wall injury complicated by RVI, consider a fluid bolus to enhance preload prior to Nitrate administration. **(NOTE: Use NTG cautiously!)**
7. For patients with moderate to severe chest pain/discomfort, consider the administration of parenteral analgesics as outlined in **Tab 900 Section T: Pain Management**. For ECG changes suggestive of inferior wall injury complicated by RVI, consider a fluid bolus to enhance preload prior to any parenteral analgesic administration that effects blood pressure.
8. Consider 2<sup>nd</sup> IV access point (i.e. saline lock) for patients who may require specialized care (STEMI).
9. For severe nausea and/or vomiting administer Zofran 4mg SL / IV / IN / IM. Zofran may be repeated x 1 in 5-10 minutes PRN.
10. ***ECG changes indicative of myocardial injury (STEMI) should be diverted to one of the PCI hospitals designated by Lucas County EMS. The current PCI Hospitals are:***
  - a. Toledo
  - b. St. Lukes
  - c. Mercy St. Vincent Medical Center
  - d. University of Toledo Medical Center
  - e. Mercy St. Anne



# G Discontinuation of Prehospital Resuscitation



## Policy:

Unsuccessful cardiopulmonary resuscitation (CPR) and other advanced life support (ALS) interventions may be discontinued prior to transport when this procedure is followed:

## Purpose:

The purpose of this policy is to:

- Allow for discontinuation of prehospital resuscitation after the delivery of adequate and appropriate ALS therapy.

## Procedure:

1. Discontinuation of CPR and ALS intervention may be implemented **after contact with *On-Line Medical Control* if ALL** of the following criteria have been met:

- Patient must be 18 years of age or older;
- Adequate CPR has been administered including use of ResQPOD (or ITD equivalent);
- The victim must **not** be in arrest due to hypothermia;
- Airway has been successfully managed with verification of device placement. Acceptable management techniques include orotracheal intubation, nasotracheal intubation, Blind Insertion Airway Device (KING, LMA, Combitube, etc.), BV attached to tracheostomy tube, or cricothyrotomy;
- IO or IV access has been achieved;
- Rhythm-appropriate medications and defibrillations have been administered according to protocol;
- Asystole or agonal rhythm are present and persistent for > 10 minutes, and no reversible causes are identified after a minimum of 30 minutes of resuscitation:
  - ***End-Tidal CO<sub>2</sub> measurements < 15mm Hg sustained throughout therapy requires, at a minimum, 20 minutes of resuscitation.***
- Failure to establish sustained palpable pulses;
- Absence of neurological activity (i.e., eye opening, motor responses);
- All EMS paramedic personnel involved in the patient's care agree that discontinuation of the resuscitation is appropriate;





# G Discontinuation of Prehospital Resuscitation



Discontinuation of Prehospital Resuscitation (cont.),

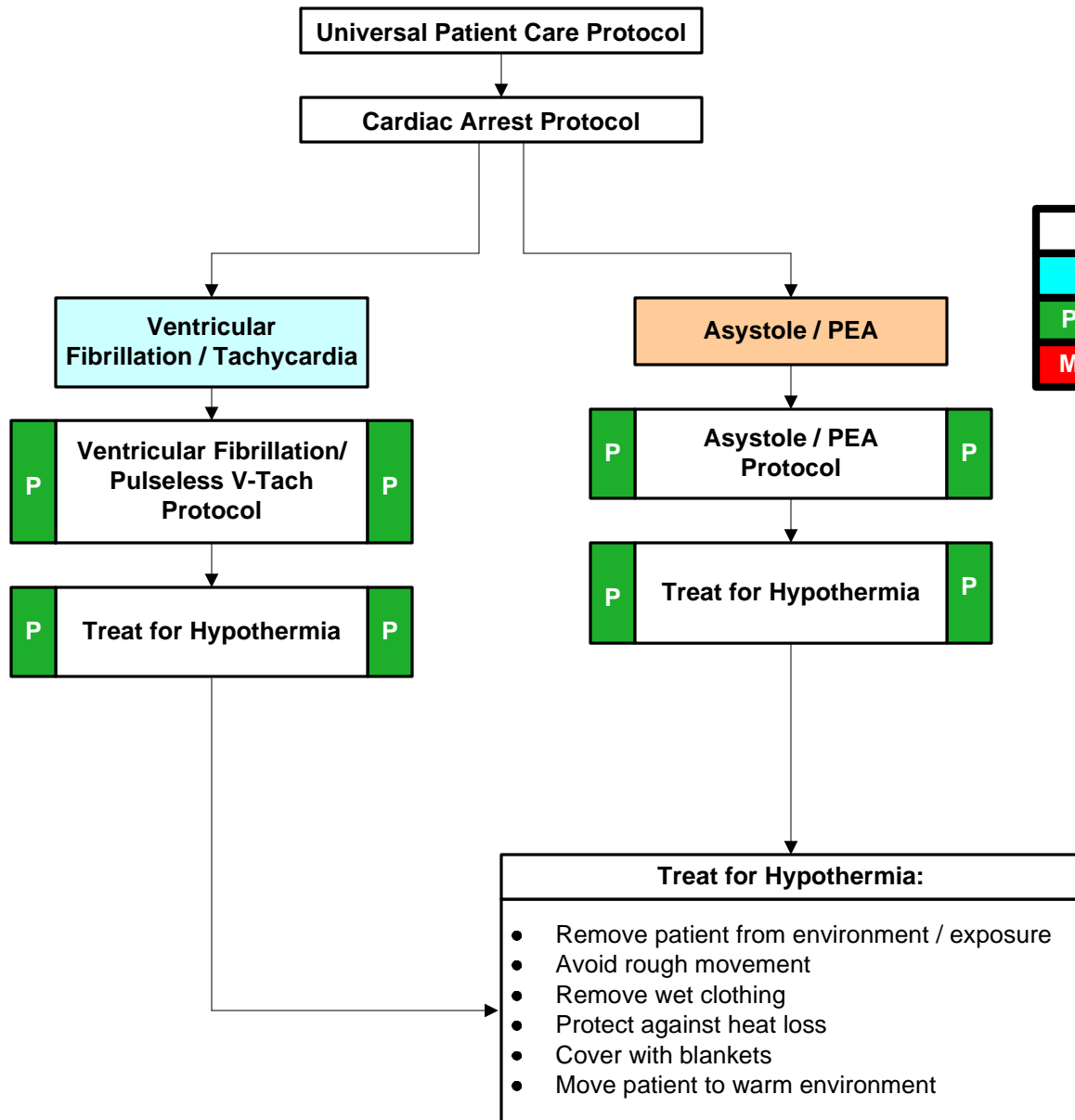
- ***On-Line Medical Control*** contact with permission by physician to terminate resuscitative efforts in the field.
2. The **Deceased Persons Protocol (Tab 900: Section K)** should be followed.

***Document all patient care and interactions with the patient's family, personal physician, medical examiner, law enforcement, and medical control in the EMS patient care report (PCR).***

# H Hypothermic Cardiac Arrest



<b>History:</b> <ul style="list-style-type: none"> <li>• Hypothermia</li> <li>• Time of arrest</li> <li>• Medical history</li> <li>• Medications</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>• Unresponsive</li> <li>• Cardiac arrest</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>• Hypothermia</li> <li>• Exposure</li> <li>• H's and T's</li> </ul>
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Legend		
	EMT	
P	EMT-P	P
M	MC Order	M



# H Hypothermic Cardiac Arrest



## Special Considerations:

1. This protocol applies to patients in cardiac arrest from suspected hypothermia.
2. Passive re-warming can be initiated in the field with application of blankets and movement of the victim to a warm environment. Severely hypothermic patients will require active internal warming upon arrival to the emergency department.
3. Patients in hypothermic cardiac arrest will require CPR with some modifications of conventional BLS and ACLS care (see guidelines below).
4. Acquire temperature in the hypothermic arrest patient (tympanic / esophageal) and factor into the overall approach to treatment (see guidelines below).
5. When the victim is hypothermic, pulse and respiratory rates may be slow or difficult to detect. For these reasons breathing and pulse should be assessed for 30-45 seconds to confirm respiratory arrest, pulseless cardiac arrest, or bradycardia that is profound enough to require CPR.
6. The temperature at which defibrillation should first be attempted in the severely hypothermic patient and the number of defibrillation attempts that should be made have not been established. The following guidelines should be considered:
  - A. **Moderate Hypothermia (30°C to 34°C):** Start CPR, attempt defibrillation, establish IO/IV access, give IO/IV medications spaced at longer intervals, initiate re-warming.
  - B. **Severe Hypothermia (<30°C):** Start CPR, attempt defibrillation (x 1), withhold medications until temperature > 30°C, initiate re-warming.
7. To prevent further core heat loss, remove wet garments and protect the victim from further environmental exposure.
8. ACLS management of cardiac arrest due to hypothermia focuses on more aggressive active core re-warming techniques as the primary therapeutic modality.



# H

## Hypothermic Cardiac Arrest



Special Considerations (cont.),

9. The hypothermic heart may be unresponsive to cardiovascular drugs, pacemaker stimulation, and defibrillation. In addition, drug metabolism is reduced. There is concern that in the severely hypothermic victim, cardioactive medications can accumulate to toxic levels in the peripheral circulation if given repeatedly. For these reasons IV drugs are often withheld if the victim's core body temperature is  $< 30^{\circ}\text{C}$  ( $86^{\circ}\text{F}$ )
10. As noted previously, a defibrillation attempt is appropriate if VF/VT is present. If the patient fails to respond to the initial defibrillation attempt or initial drug therapy, defer subsequent defibrillation attempts or additional boluses of medication until the core temperature rises above  $30^{\circ}\text{C}$  ( $86^{\circ}\text{F}$ ).

# I ICE Induced Cooling by EMS



<b>History:</b> <ul style="list-style-type: none"> <li>Cardiac Arrest not related to blunt/penetrating trauma or hemorrhage</li> <li>≥ 16 years of age</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>Cardiac Arrest</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>Continue to address specific differentials associated with the original dysrhythmia</li> </ul>
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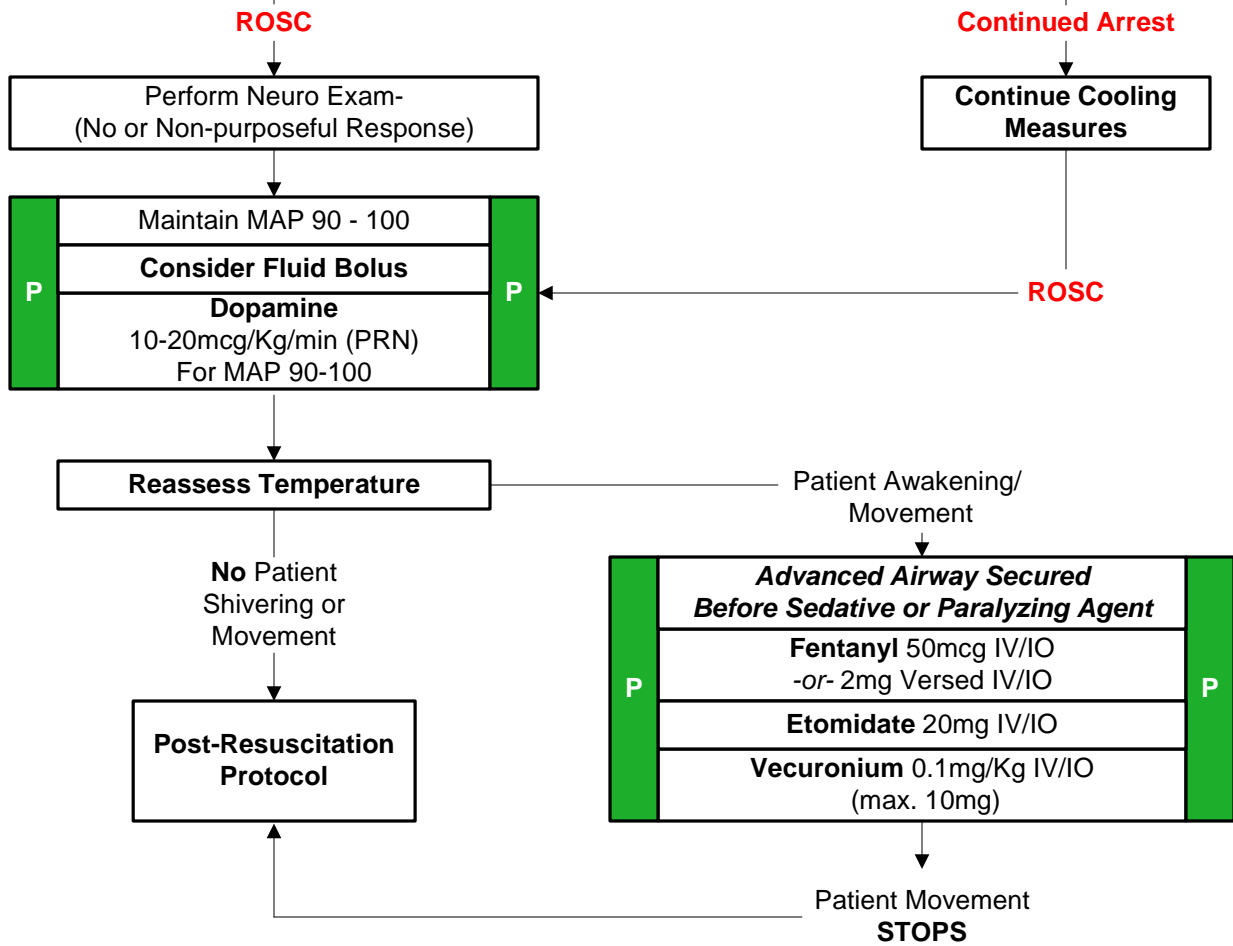
**Cardiac Arrest / Rhythm-Appropriate Protocol**

Temperature Monitoring

**Intra-arrest Therapeutic Hypothermia**  
*Cryo-Cooling Element applied to neck*

Monitor EtCO2  
**DO NOT  
HYPERVENTILATE**

Legend		
	EMT	
P	EMT-P	P
M	MC Order	M





# I ICE Induced Cooling by EMS



Current research has shown, almost universally, that therapeutic hypothermia improves mortality and functional neurologic outcomes in patients resuscitated from pulseless arrest.

Paramedics play an important role in beginning the therapeutic hypothermia process, which usually must continue for a minimum of 24 hours following cardiac arrest. Since therapeutic hypothermia benefits decrease drastically after a delay of even a few minutes, EMS may be in the best position to begin immediate treatment.

## **Criteria for Induced Hypothermia:**

1. Cardiac arrest not related to trauma or hemorrhage
2. Age  $\geq$  16
3. Not obviously pregnant

## **Special Considerations:**

1. Intra-arrest therapeutic hypothermia is accomplished by placing an Excel Cryo-Cooling element on the anterior surface of the neck at (or near) the beginning of resuscitation. Cooling elements should be changed every 20 minutes during the resuscitative process.
2. During intra-arrest therapeutic hypothermia (IATH), measure initial patient temperature with tympanic thermometer. Continually monitor temperature readings throughout cardiac arrest care.
3. Continue to address specific differentials associated with original dysrhythmia or cause of arrest (H's and T's).

## **Return of Spontaneous Circulation**

1. In patients with return of spontaneous circulation (ROSC), the first visualized sign may be a significant increase in capnographic waveform and capnogram value. CO<sub>2</sub> washout through the lungs upon return of mechanical circulation proves a valuable sign of ROSC and should prompt the paramedic in the field to assess patient circulation (pulses). Monitor EtCO<sub>2</sub> frequently and target value at 40mm Hg. If EtCO<sub>2</sub> values fall below 20mm Hg, consider possible loss of pulses.



# I ICE Induced Cooling by EMS



## Intra-Arrest Therapeutic Hypothermia (cont.),

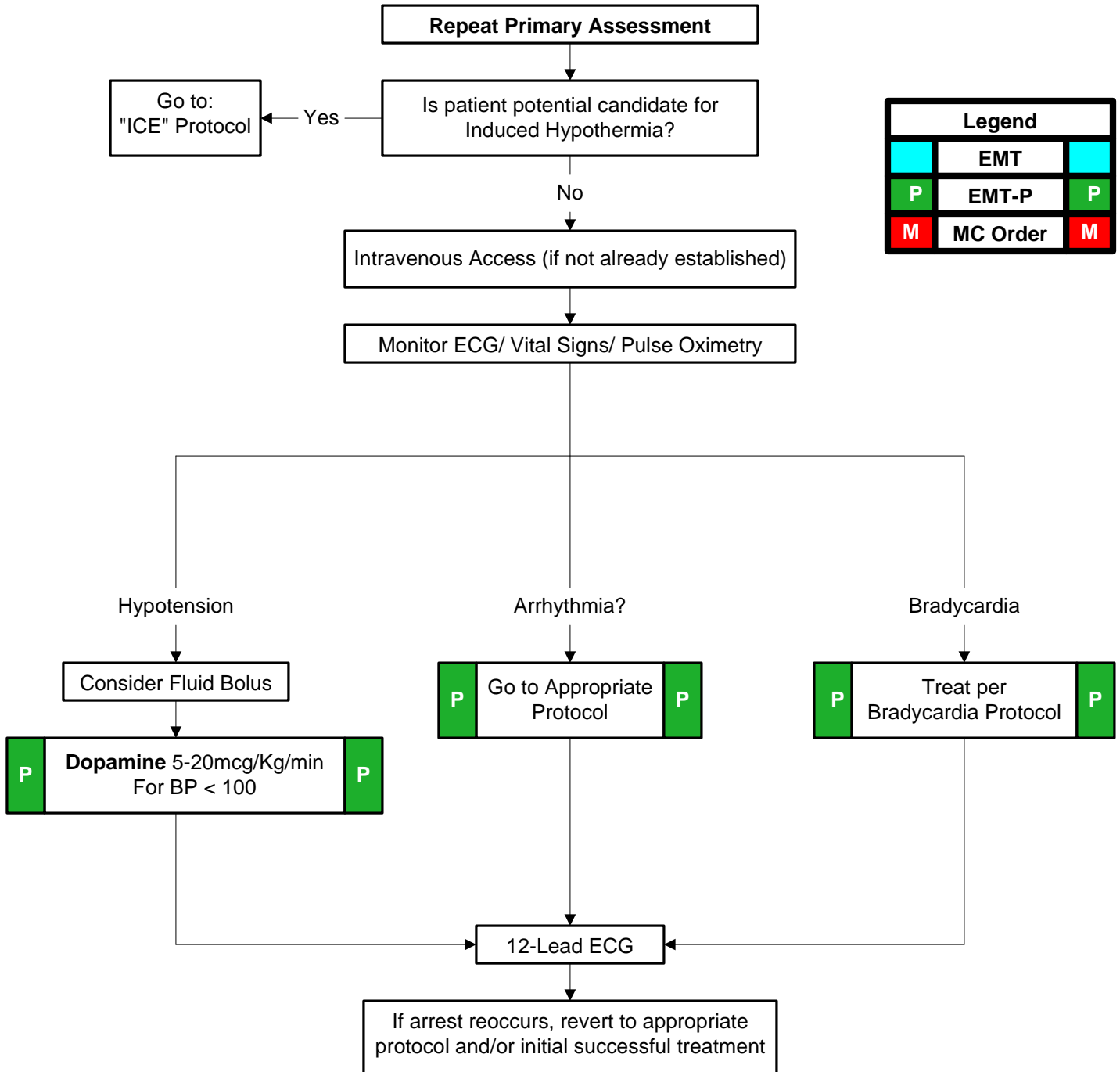
2. Patient assessment is critical upon achieving ROSC. Assure sustained perfusing rhythm and vital signs. Patients should be prepared for transport to the closest assigned hypothermia center.
3. During post-arrest therapy, patient assessment is critical for ongoing care: With any witnessed signs of patient movement (i.e., gasping, seizure activity, or movement) during IATH therapy, administer 50mcg Fentanyl IV/IO (**in the absence of Fentanyl, administer 2mg Versed IV/IO**), 20mg Etomidate IV/IO and Vecuronium (Norcuron) 0.1mg/Kg IV/IO (max. 10mg). **NOTE: An advanced airway MUST be secured in place before administration of sedative or paralytic agents.** Repeat dosing of sedative or paralytic agents, if necessary during on-going care, may be administered through **On-Line Medical Control** order.
4. Maintaining cerebral perfusion is essential during the therapeutic hypothermia process. Maintain MAP (Mean Arterial Pressure) at 90-100. Fluid bolus may be necessary to maintain MAP. MAP values below 90 after saline infusion may require pressor administration (Dopamine) for adequate perfusion pressures.
5. Reassess the patient's airway frequently and with every patient movement.
6. **DO NOT** hyperventilate.
7. If there is a loss of ROSC at any time, continue intra-arrest therapeutic hypothermia and go to appropriate protocol for treatment.

## Transport Considerations

1. Any adult ( $\geq 16$ ) cardiac arrest not related to trauma or hemorrhage should be triaged to the closest "STEMI" / "Hypothermia" Center. Upon notification, LCEMS Dispatch will determine the closest open facility, and assign med channel for MC contact.
2. "STEMI"/ "Hypothermia" Centers include St. Lukes, St. Vincent Mercy Medical Center (SVMMC), The Toledo Hospital (TTH), and The University of Toledo Medical Center (UTMC) and Mercy St. Anne.
3. Upon patient delivery to ED measure final patient temperature with tympanic thermometer.



<b>History:</b> <ul style="list-style-type: none"> <li>Respiratory Arrest</li> <li>Cardiac Arrest</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>Return of Pulse (ROSC)</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>Continue to address specific differentials associated with the original dysrhythmia</li> </ul>
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Legend		
	EMT	
P	EMT-P	P
M	MC Order	M





# J Post Resuscitation Care



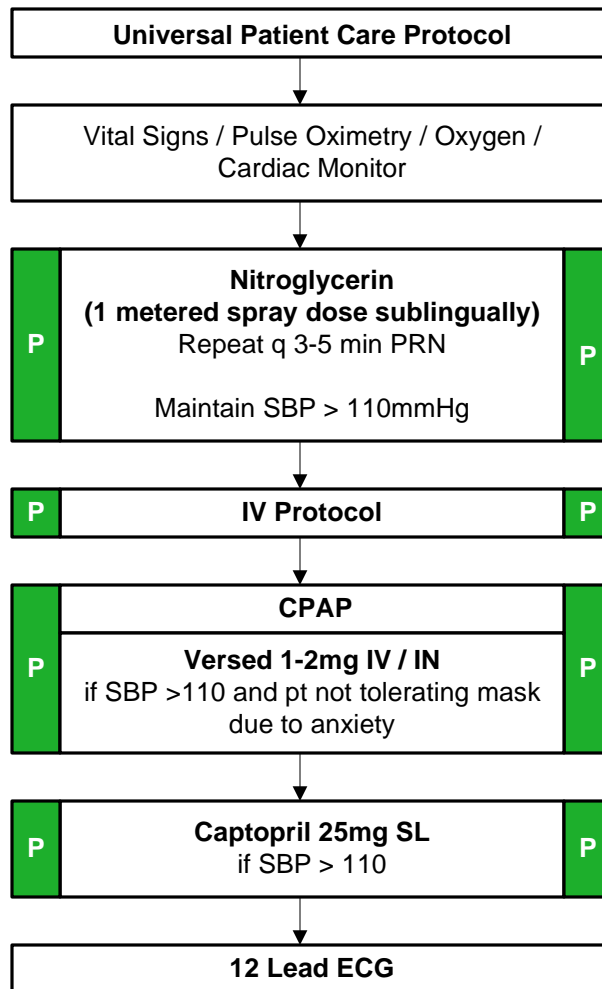
## Special Considerations:

1. Exam: Mental Status, Neck, Skin, Lungs, Heart, Abdomen, Extremities, Neuro.
2. Hyperventilation is a significant cause of hypotension and recurrence of cardiac arrest in the post- resuscitation phase and must be avoided at all costs.
3. Most patients during post–resuscitation care will require ventilatory assistance.
4. The condition of post -resuscitation patients fluctuates rapidly and continuously, and they require close monitoring. Appropriate post-resuscitation management may be planned in consult with ***On-Line Medical Control***.
5. Common causes of post-resuscitation hypotension include hyperventilation, hypovolemia, pneumothorax, and medication reaction to ALS drugs.
6. Titrate Dopamine to maintain MAP > 90. Ensure adequate fluid resuscitation.

# K Pulmonary Edema



<p><b>History:</b></p> <ul style="list-style-type: none"> <li>• Congestive heart failure</li> <li>• Past medical history</li> <li>• Medications (Digoxin, Lasix)</li> <li>• Viagra, Levitra, Cialis</li> <li>• Cardiac history - past myocardial infarction</li> </ul>	<p><b>Signs / Symptoms:</b></p> <ul style="list-style-type: none"> <li>• Respiratory distress, bilateral rales</li> <li>• Apprehension, orthopnea</li> <li>• Jugular vein distention</li> <li>• Pink, frothy sputum</li> <li>• Peripheral edema, diaphoresis</li> <li>• Hypotension, shock</li> <li>• Chest pain</li> </ul>	<p><b>Differential:</b></p> <ul style="list-style-type: none"> <li>• Myocardial infarction</li> <li>• Congestive heart failure</li> <li>• Asthma</li> <li>• Anaphylaxis</li> <li>• Aspiration</li> <li>• COPD</li> <li>• Pleural effusion</li> <li>• Pneumonia</li> <li>• Pulmonary embolus</li> <li>• Pericardial tamponade</li> <li>• Toxic exposure</li> </ul>
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Legend		
	EMT	
P	EMT-P	P
M	MC Order	M

# K Pulmonary Edema



## Special Considerations:

1. Current strategies in the prehospital treatment of CHF and acute pulmonary edema include correction of hypoxemia and administration of medications to improve cardiac output.
2. Immediately begin administration of 100% oxygen via a non-rebreather mask. This will maximize oxygen concentration and fully saturate circulating hemoglobin. If a patient is in extreme distress, it may be appropriate to proceed to immediate intubation and ventilation.
3. Continuous Positive Airway Pressure (CPAP) has been shown to rapidly improve vital signs, gas exchange, reduce the work of breathing, decrease the sense of dyspnea, and decrease the need for endotracheal intubation in patients who suffer from pulmonary edema (CHF). CPAP also improves hemodynamics by reducing left ventricular preload and afterload. For pulmonary edema / CHF start with a 10.0 cm pressure valve setting. If the patient is not tolerating the 10.0 cm pressure setting, consider decreasing to 7.5 cm. Any patient anxiety related to CPAP use should be treated as outlined in item #7.
4. Monitor End-Tidal CO<sub>2</sub> via O<sub>2</sub> / CO<sub>2</sub> Nasal FilterLine during CPAP operation.
5. The first step in the pharmacologic management of CHF and acute pulmonary edema is aimed at reducing preload with the use of Nitrates (NTG). Nitroglycerin is a preload-reducing agent that also decreases the workload of the heart. Nitroglycerin dosing for the patient with CHF can be more aggressive than for the angina or coronary patient. NTG spray is most useful in the acute care setting, but redosing will require temporary CPAP mask removal. **Administer Nitroglycerin (1 metered spray dose sublingually) q 3-5 minutes as long as SBP > 110mmHg.** If Nitroglycerin spray is not available, SL tablet may be substituted with same dosing regimen (q 3-5 minutes).
6. Nitrates should not be used in patients who have taken one of the erectile dysfunction (ED) drugs. Generally, you should avoid the administration of NTG if the patient has taken Sildenafil (Viagra) or Vardenafil (Levitra) in the prior 24 hours or Tadalafil (Cialis) in the prior 48 hours. Fatal hypotension has been reported when NTG has been administered to patients taking ED medications.



### Special Considerations (cont.),

7. Patients, who remain anxious after CPAP application, or after the correction of hypoxia, may benefit from anxiolytic therapy. **Consider Versed 1-2mg IV if SBP > 110mmHg.** Absent IV access, administer Versed IN. Versed is more effective on anxiety than morphine and does not have the adverse vascular effects. Maximum dose of Versed is 2mg IV / IN. Any additional Versed dosing must be authorized by ***On-Line Medical Control***.
8. The second step in the treatment of the patient with CHF or pulmonary edema is to reduce afterload – that is, to reduce the pressure and resistance that the left ventricle has to pump against, so that cardiac output will be improved. By improving cardiac output, renal blood flow will be improved and diuresis may be afforded. **Captopril (ACE Inhibitor)** will assist in lowering blood pressure, cause vasodilation of the arterial system, improve cardiac output and cause blood volume reduction via the excretion of sodium in the urine. Captopril administration should be considered after the initiation of Nitro therapy and application of CPAP. **Captopril is administered sublingually. A 25 mg pill can be wetted and placed under the tongue and will begin working within 15 minutes. Administer Captopril SL only if BP > 110mm Hg.**
9. Some patients with decompensated CHF will have such poor perfusion they would be classified as having cardiogenic shock. This small subset of patients may not tolerate any preload or afterload reduction and may, in fact, need inotropic support (Dopamine) to maintain any blood pressure. Unfortunately, the mortality rate for this group of patients is very high, despite therapy.

# L Pulseless Electrical Activity (PEA)



<b>History:</b> <ul style="list-style-type: none"> <li>• Past medical history</li> <li>• Medications</li> <li>• Events leading to arrest</li> <li>• ESRD</li> <li>• Estimated down time</li> <li>• Suspected hypothermia</li> <li>• Suspected overdose</li> <li>• DNR</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>• Pulseless</li> <li>• Apneic</li> <li>• Electrical Activity on ECG</li> <li>• No auscultated heart tones</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>• Hypovolemia (Trauma, AAA, other)</li> <li>• Cardiac tamponade</li> <li>• Hypothermia</li> <li>• Drug overdose (Tricyclics, Digitalis, Beta Blockers, Calcium channel blockers)</li> <li>• Massive myocardial infarction</li> <li>• Hypoxia</li> <li>• Tension Pneumothorax</li> <li>• Pulmonary embolus</li> <li>• Acidosis</li> <li>• Hyperkalemia</li> </ul>
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Universal Patient Care Protocol

Cardiac Arrest Protocol

Adult Airway Protocol  
**Do Not Stop CPR**  
For advanced airway placement

**Begin Continuous Chest Compressions**  
ResQCPR (ACD-CPR + ITD) @80/min

Legend		
	EMT	
P	EMT-P	P
M	MC Order	M

E	<b>Intra-arrest Therapeutic Hypothermia</b> <i>Cryo-Cooling Element applied to neck</i>	E
P	Intravenous Access (IO/IV)	P

P	<b>Epinephrine 1mg (0.1mg/mL)</b> IO/IV q 5 min.	P
P	Establish secondary circulatory access point	P

AT ANY TIME  
Return of Spontaneous  
Circulation  
  
Go to  
Post-Resuscitation  
Protocol

P	<b>Considerations in PEA:</b>	P
P	Insufficient volume ( <b>Fluid Bolus</b> ) Low Blood Sugar ( <b>D50</b> ) Overdose ( <b>Narcan</b> )	P
P	Potassium / Renal ( <b>Calcium Chloride</b> ) Potassium / Renal / Tricyclic ( <b>Na Bicarb</b> ) Volume ( <b>Dopamine</b> ) Beta Blocker OD ( <b>Glucagon</b> ) Compromised chest cavity ( <b>Decompression</b> )	P

Criteria for Discontinuation

M	Discontinuation of Prehospital Resuscitation Protocol	M
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Continue Resuscitation

# L Pulseless Electrical Activity PEA



### Special Considerations:

1. PEA encompasses a heterogeneous group of rhythms that are organized or semi-organized, but lack of palpable pulse. Any organized rhythm without a pulse is defined as PEA. Pulseless rhythms that are excluded by definition include VF, VT and Asystole.
2. The ability to achieve a good resuscitation outcome with a return of a perfusing rhythm and spontaneous respirations depends on the ability to provide effective CPR and to identify and correct a cause of PEA if present.
3. Rapid assessment and aggressive management offer the best chance of success. PEA may be caused by a reversible problem. If you can quickly identify a specific condition that has caused or is contributing to PEA and correct it, you may achieve ROSC. The identification of the underlying cause is of paramount importance in cases of PEA and Asystole.
4. The most common causes of PEA are presented as H's and T's in the table below:

H's	T's
Hypovolemia	Tension Pneumothorax
Hypoxia	Tamponade (cardiac)
Hydrogen ion (acidosis)	Toxins
Hyper- / hypokalemia	Thrombosis (pulmonary)
Hypothermia	Thrombosis (coronary)

5. Hypovolemia and hypoxia are the 2 most common and easily reversible causes of PEA. Be sure to look for evidence of these problems as you assess the patient.
6. Discussion with ***On-Line Medical Control*** can be a valuable tool in developing a differential diagnosis and identifying possible treatment options.

# L Pulseless Electrical Activity PEA



Special Considerations (cont.),

**Potentially Reversible Causes of PEA (H's):**

Condition	Clues From ECG and Monitor	Clues From History And Physical Examination	Potential Effective Interventions
<b>Hypovolemia</b>	Narrow Complex Rapid rate	History, flat neck veins	Volume infusion
<b>Hypoxia</b>	Slow rate (hypoxia)	Cyanosis, airway problems	Oxygenation, ventilation, Advanced airway
<b>Hydrogen ion (acidosis)</b>	Smaller-amplitude QRS complexes	History of diabetes, bicarbonate-responsive preexisting acidosis, renal failure	Ventilation, sodium bicarbonate
<b>Hyperkalemia</b>	<p><i>"High-potassium" ECG:</i></p> <ul style="list-style-type: none"> <li>• T waves taller and peaked</li> <li>• P waves get smaller</li> <li>• QRS widens</li> <li>• Sine-wave PEA</li> </ul>	History of renal failure, diabetes, recent dialysis, dialysis fistulas, medications	<p><i>Hyperkalemia:</i></p> <ul style="list-style-type: none"> <li>• Calcium Chloride</li> <li>• Sodium Bicarbonate</li> </ul>
<b>Hypokalemia</b>	<p><i>"Low potassium" ECG:</i></p> <ul style="list-style-type: none"> <li>• T waves flatten</li> <li>• Prominent U waves</li> <li>• QRS widens</li> <li>• QT prolongs</li> <li>• Wide-complex tachycardia</li> </ul>	Abnormal loss of potassium, diuretic use	<p><i>Hypokalemia:</i></p> <p>Add magnesium if cardiac arrest</p>
<b>Hypothermia</b>	J or Osborne waves	History of exposure to cold, central body temperature	Hypothermia protocol

# L Pulseless Electrical Activity PEA



Special Considerations (cont.),

**Potentially Reversible Causes of PEA (T's):**

Condition	Clues From ECG and Monitor	Clues From History And Physical Examination	Potential Effective Interventions
<b>Tension Pneumothorax</b>	Narrow complex Slow rate (hypoxia)	History, no pulse felt with CPR, neck vein distention, tracheal deviation, unequal breath sounds, difficult to ventilate patient	Needle decompression
<b>Tamponade, cardiac</b>	Narrow complex Rapid rate	History, no pulse felt with CPR, vein distention	Pericardiocentesis
<b>Toxins (drug OD): Tricyclics, digoxin, β-Blockers, calcium channel blockers</b>	Various effects on ECG, predominately prolongation of QT interval	Bradycardia, empty bottles at the scene, pupils, neurologic exam	Intubation, specific antidotes and agents per toxidrome
<b>Thrombosis, lungs: Massive pulmonary embolism</b>	Narrow complex Rapid rate	History, no pulse felt with CPR, distended neck veins, prior positive test for deep vein thrombosis or pulmonary embolism	Surgical embolectomy, fibrinolytics
<b>Thrombosis, heart: Massive MI</b>	Abnormal 12-Lead ECG: <ul style="list-style-type: none"> <li>• Q waves</li> <li>• ST-segment changes</li> <li>• T waves, inversions</li> </ul>	History, cardiac markers, good pulse with CPR	





# M STEMI Alert



Patients with 12-Lead ECG signs indicative of ST-segment elevation myocardial infarction (STEMI) will be triaged to the closest available PCI (Percutaneous Coronary Intervention) facility for treatment.

Current PCI Facilities:

- University of Toledo Medical Center
- Promedica Toledo Hospital
- Mercy St. Vincent Medical Center
- Mercy St. Anne Hospital
- St. Lukes

## STEMI Criteria:

1. ST-segment elevation, measured at the J-point, of 1mm or more.
2. ST-segment elevation must be present in two anatomically contiguous leads.
3. Probable new-onset BBB. (Consider Sgarbossa Criteria)

## STEMI ALERT Procedure:

1. Acquire 12-Lead ECG as outlined in the 12-Lead ECG protocol (Tab 800, Section R).
2. 12-Lead interpretation indicative of myocardial injury (STEMI).
  - a. Localize area of injury (Septal, Anterior, Inferior, etc.).
  - b. Rule out possible ACS imitators:
    - i. Bundle branch block (BBB)
    - ii. Left ventricular hypertrophy (LVH)
    - iii. Ventricular Rhythms
    - iv. Benign Early Repolarization (BER)
    - v. Pericarditis
3. Declare a "STEMI ALERT" through Lucas County EMS Dispatch and the closest PCI facility will be assigned as **On-Line Medical Control** (if not already assigned). Patients who display patterns on the 12-Lead ECG that mimic ACS (i.e., BBB, LVH, etc) should be transported to the closest appropriate hospital assigned by Lucas County EMS Dispatch.

Tab 800  
STEMI Alert M-1  
06/2015



## **M STEMI Alert**



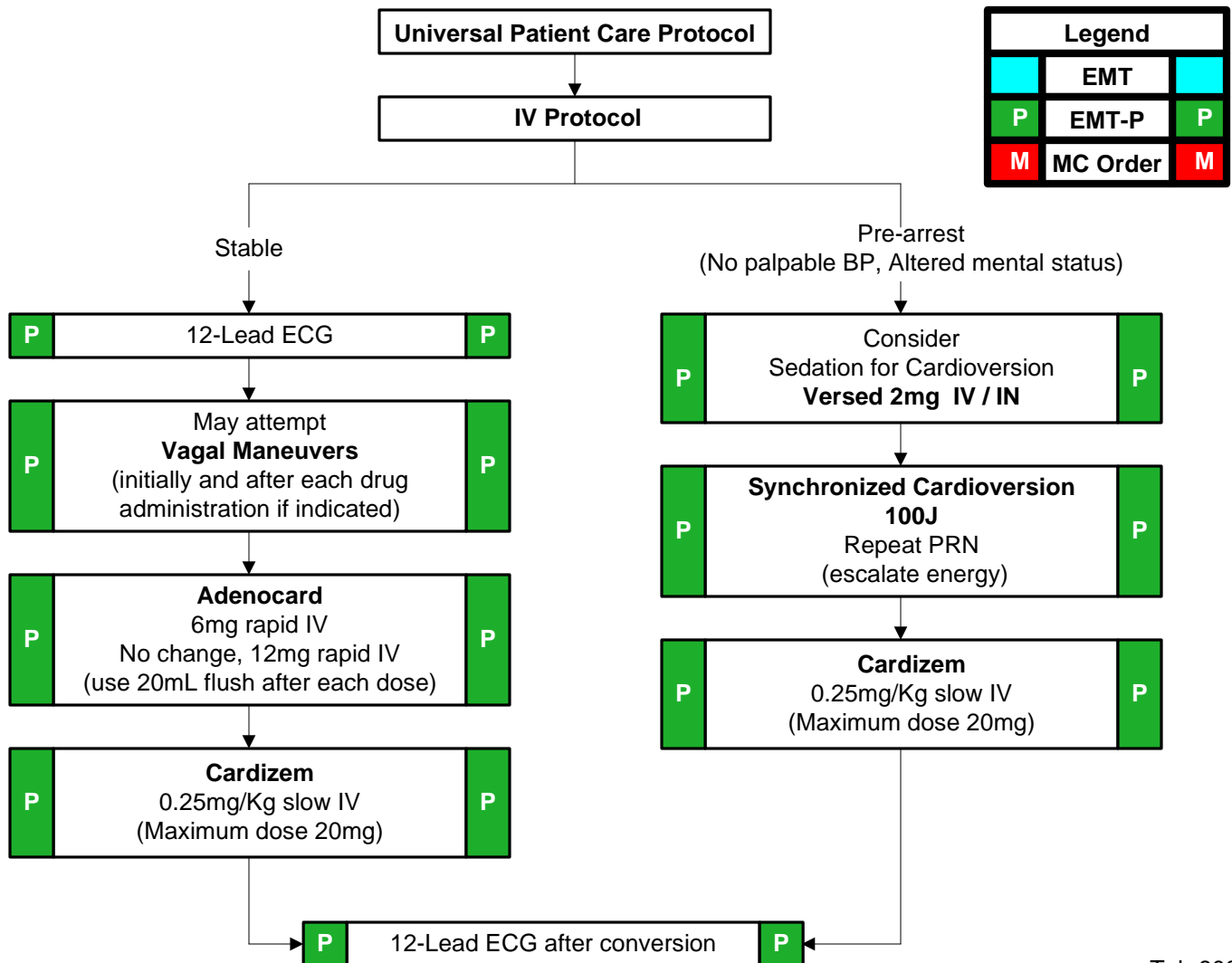
STEMI Alert, continued

4. Transmit 12-Lead ECG to the assigned receiving PCI facility as time permits. Notify On-Line Medical Control, during patient assessment transmission, that 12-Lead ECG has been sent. Follow guidelines for 12-Lead transmission as detailed in the 12-Lead Transmission Protocol (Tab 800, Section S).

# N Supraventricular Tachycardia

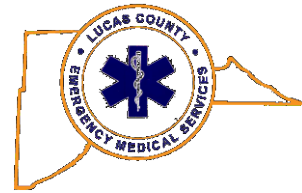


<p><b>History:</b></p> <ul style="list-style-type: none"> <li>• Medications Aminophylline Diet pills Thyroid supplements Decongestants Digoxin</li> <li>• Diet (caffeine, chocolate)</li> <li>• Drugs (nicotine, cocaine)</li> <li>• Past medical history</li> <li>• History of palpitations / heart racing</li> <li>• Syncope / near-syncope</li> </ul>	<p><b>Signs / Symptoms:</b></p> <ul style="list-style-type: none"> <li>• HR &gt; 150/min</li> <li>• QRS &lt; 0.12 sec</li> <li>• <b>QRS &gt; 0.12 sec - Go to V-Tach Protocol</b></li> <li>• <b>If history of WPW, go to V-Tach Protocol</b></li> <li>• Dizziness, CP, SOB</li> <li>• Potential presenting rhythm: Sinus Tachycardia Atrial Fibrillation / Flutter Multifocal Atrial Tachycardia</li> </ul>	<p><b>Differential:</b></p> <ul style="list-style-type: none"> <li>• Heart disease (WPW, Valvular)</li> <li>• Sick sinus syndrome</li> <li>• Myocardial infarction</li> <li>• Electrolyte imbalance</li> <li>• Exertion, pain, emotional stress</li> <li>• Fever</li> <li>• Hypoxia</li> <li>• Hypovolemia or anemia</li> <li>• Drug effect / Overdose</li> <li>• Hyperthyroidism</li> <li>• Pulmonary embolus</li> </ul>
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# N Supraventricular Tachycardia

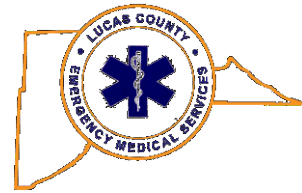


## Special Considerations:

1. This protocol applies to the patient who is symptomatic due to supraventricular tachycardia.
2. Tachycardia can be caused by many underlying factors. Consider the following possible causes and, if verified, render the appropriate treatment:
  - Hypovolemia
  - Hypoxia
  - Hydrogen Ion (Acidosis)
  - Hyper/Hypokalemia
  - Hypothermia
  - Hypoglycemia
  - Toxins (poisons, overdose)
  - Tamponade, Cardiac
  - Tension Pneumothorax
  - Thrombosis, Coronary/Pulmonary
3. Reentry SVT is a regular tachycardia that is caused by reentry, an abnormal rhythm circuit that allows a wave of depolarization to travel in a circle. The rate of reentry SVT exceeds the typical upper limits of sinus tachycardia at rest (> 150 beats per minute) with or without discernible P waves. Vagal maneuvers and Adenocard are the preferred initial therapeutic choices for the termination of stable reentry SVT.
4. For reentry SVT that does not respond to vagal maneuvers, administer 6mg of Adenocard as a rapid IV push (Class I). Give Adenocard rapidly over 1 to 3 seconds through a large (e.g., antecubital) vein followed by a 20mL saline flush. If the rate does not convert within 1 to 2 minutes, administer Adenocard 12mg. If SVT persists, and patient stable, you may consider a second 12mg bolus of Adenocard after 1 to 2 minutes.
5. If Adenocard fails to convert reentry SVT, attempt rate control with Cardizem. Administer Cardizem 0.25mg/Kg (maximum dose 20mg) IV over 2 minutes. If needed, for further rate control, in 15 minutes give an IV dose of Cardizem at 0.35mg/Kg (maximum dose 25mg) IV over 2 minutes.



# N Supraventricular Tachycardia

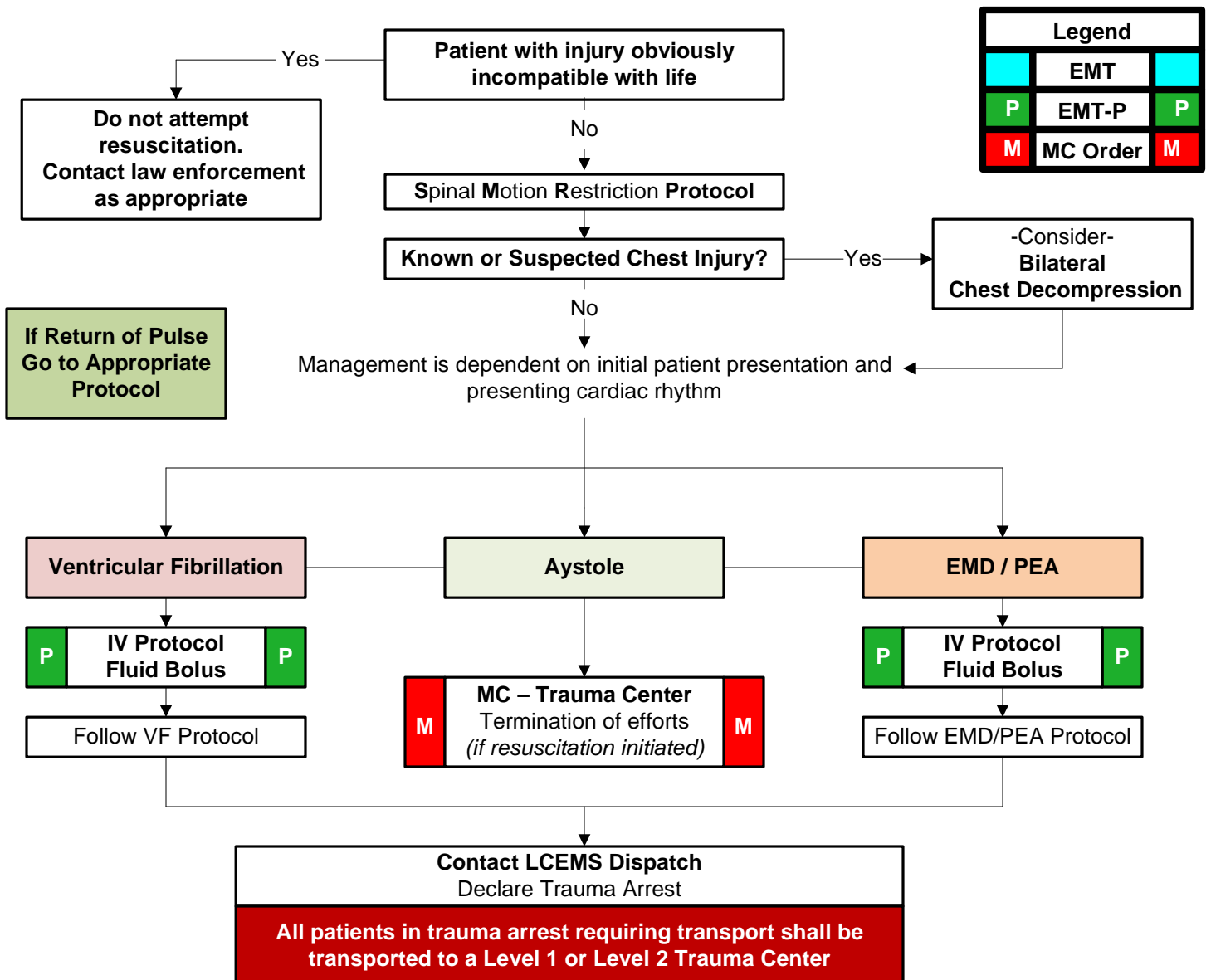


## Special Considerations (cont.),

6. If patient develops an adverse reaction to Cardizem infusion (i.e., hypotension, bradycardia, heart-block), administer Calcium Chloride 1Gm over 5 minutes. Mix 1Gm of Calcium Chloride in a 50mL bag of D5W. With (10gtt) administration set, run at 100gtts/min. Continue Calcium Chloride drip until adverse symptoms resolve.
7. Unstable SVT may require synchronized cardioversion starting at 100 Joules. Escalate as necessary for rhythm conversion (100J - 200J - 300J - 360J).
8. Patients requiring sedation prior to synchronized cardioversion should receive Versed 2mg slow IV. Absent IV access, consider administration of Versed 2mg IN.
  - If Versed allergy exists, consider analgesic administration as outlined in **Tab 900 Section T: Pain Management.**
9. If a known pre-excitation syndrome is identified by either ECG or patient history (i.e., Wolff-Parkinson-White Syndrome [WPW]), do not administer Adenocard or Cardizem. These drugs can cause a paradoxical increase in the ventricular response to the rapid atrial impulses passing through an accessory AV pathway. ***If WPW is suspected, treat per the Ventricular Tachycardia/Wide Complex with a Pulse Protocol (Tab 800, Section Q).***



<p><b>History:</b></p> <ul style="list-style-type: none"> <li>• Patient who has suffered traumatic injury and is now pulseless</li> </ul>	<p><b>Signs / Symptoms:</b></p> <ul style="list-style-type: none"> <li>• Evidence of penetrating trauma</li> <li>• Evidence of blunt trauma</li> </ul>	<p><b>Differential:</b></p> <ul style="list-style-type: none"> <li>• Medical condition preceding traumatic event as cause of arrest</li> <li>• Tension Pneumothorax</li> <li>• Hypovolemic shock                     <ul style="list-style-type: none"> <li>External hemorrhage</li> <li>Unstable pelvic fracture</li> <li>Displaced long bone fracture(s)</li> <li>Hemothorax</li> <li>Intra-abdominal hemorrhage</li> <li>Retroperitoneal hemorrhage</li> </ul> </li> </ul>
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# O Traumatic Cardiac Arrest



## Special Considerations:

1. This protocol applies to the adult patient who has sustained cardiac arrest from significant trauma.
2. Common errors in trauma resuscitation include failure to open and maintain the airway, failure to provide appropriate fluid resuscitation, and failure to recognize and treat internal bleeding.
3. When the mechanism of injury is compatible with spinal injury, restrict motion of the cervical spine and avoid traction or movement of the head and neck. Open and maintain the airway with a jaw thrust, and do not tilt the head.
4. Do not over-ventilate even in case of head injury. Intentional brief hyperventilation may be used as a temporizing rescue therapy when you observe signs of impending brain herniation.
5. Suspect thoracic injury in all thoracoabdominal traumas, even in the absence of external injuries. Tension pneumothorax, hemothorax, or pulmonary contusion may impair breathing.
6. Treat signs of volume depletion with normal saline fluid bolus as needed.
7. The most common terminal cardiac rhythms observed in victims of trauma are PEA, bradysystolic rhythms, and occasionally VF/VT. Although Epinephrine is typically administered during the ACLS treatment of these arrhythmias, it will likely be ineffective in the presence of uncorrected severe hypovolemia
8. **At any time, patients with witnessed signs of life (i.e., movement, respiratory effort, palpable pulses, etc.) by an EMS skilled observer, shall be transported to a Level 1 or Level 2 Trauma Center.**
9. All patients in trauma arrest requiring transport shall be transported to a Level 1 or Level 2 Trauma Center.



# O Traumatic Cardiac Arrest



Special Considerations (cont.),

10. Consider using medical cardiac arrest protocols if uncertainty exists regarding medical or traumatic cause of arrest.
11. Consider air ambulance response in settings where long extrication is necessary. On-scene physician and/or nurse evaluation and treatment may prove beneficial for patient survival. Mode of transport (ground vs. air) should be evaluated for most expeditious delivery of patient to the emergency department.
12. **On-Line Medical Control** radio report for transported traumatic arrest:
  - a. T – Trauma Protocol
  - b. A – Age of patient
  - c. G – Gender
  - d. E – ETA
  - e. M – Matter (briefly describe patient presentation and condition)
13. Contact On-Line Medical Control during transport if on-scene termination is not prudent due to paramedic discretion, upset family, violent scene, bystanders, or other conditions.

## **Recommendations for Withholding or Discontinuing Resuscitation in Traumatic Cardiopulmonary Arrest:**

- A. Resuscitative efforts should be withheld for trauma patients with injuries that are obviously incompatible with life, such as decapitation or hemicorporectomy.**
- B. Resuscitative efforts should be withheld for patients of either blunt or penetrating trauma when there is evidence of prolonged cardiac arrest, including rigor mortis or dependent lividity.**
- C. Resuscitative efforts may be withheld for a blunt trauma patient who, on the arrival of EMS personnel, is found to be apneic, pulseless, and without organized electrocardiographic activity (Aystolic).**





# O Traumatic Cardiac Arrest



Special Considerations (cont.),

- D. Resuscitative efforts may be withheld for a penetrating trauma patient who, on arrival of EMS personnel, is found to be pulseless and apneic and there are no other signs of life, including spontaneous movement, electrocardiographic activity (Asystolic), and pupillary response.**
- E. When the mechanism of injury does not correlate with the clinical condition, suggesting a non-traumatic cause of cardiac arrest, standard resuscitative measures should be followed.**

# Ventricular Fibrillation Pulseless Ventricular Tachycardia



<b>History:</b> <ul style="list-style-type: none"> <li>Estimated down time</li> <li>Past medical history</li> <li>Medications</li> <li>Events leading to arrest</li> <li>Renal failure/ dialysis</li> <li>DNR</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>Unresponsive, apneic, pulseless</li> <li>Ventricular fibrillation or ventricular tachycardia on ECG</li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>Asystole</li> <li>Artifact/ Device failure</li> <li>Cardiac</li> <li>Endocrine/ Metabolic</li> <li>Drugs</li> <li>Pulmonary</li> </ul>
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**Cardiac Arrest Protocol**

**Defibrillation x 1: 200J**  
(Reassess rhythm and repeat q 2 minutes)

**NOTE: VF / VT refractory to defibrillation escalate energy (300J-360J) on subsequent shocks**  
(After defibrillation resume CPR without pulse check)

Legend		
	EMT	
P	EMT-P	P
M	MC Order	M

**Begin Continuous Chest Compressions**  
ResQCPR (ACD-CPR + ITD) @80/min

Adult Airway Protocol  
**Do Not Stop CPR**  
For advanced airway placement

	<b>Intra-arrest Therapeutic Hypothermia</b> <i>Cryo-Cooling Element applied to neck</i>	
P	Intravenous Access (IO / IV)	P

P	<b>Epinephrine 1mg (0.1mg/mL)</b> IO/IV q 5 minutes	P
P	Establish secondary circulatory access point	P

P	<b>Amiodarone 300mg IO/IV</b> (May be repeated once at 150mg)	P
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P	<b>Magnesium Sulfate</b> 2Gm IO / IV push	P
---	--	---

	Apply new Defib pads at different site (e.g., Anterior-Posterior Placement)	
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Repeat Defibrillation

**AT ANY TIME**  
 Return of Spontaneous Circulation  
  
 Go to  
 Post-Resuscitation Protocol

# P

## Ventricular Fibrillation Pulseless Ventricular Tachycardia



Special Considerations:

1. Pulseless VT is included in the algorithm because it is treated as VF. VF and pulseless VT require CPR until a defibrillator is available. Both are treated with high-energy unsynchronized shocks.
2. **Effective CPR and prompt defibrillation are the keys to successful resuscitation.** Shortening the interval between the last compression and the shock by even a few seconds can improve shock success (defibrillation to ROSC). Thus, it is reasonable for healthcare providers to practice efficient coordination between CPR and defibrillation to minimize the hands-off interval between stopping compressions and administering the shock.
3. Interruption in CPR to conduct a rhythm analysis should not exceed 10 seconds.
4. Reassess and document advanced airway placement and EtCO<sub>2</sub> frequently, after every move, and upon delivery to ED.
5. The importance of diagnosing and treating the underlying cause of VF/pulseless VT is fundamental to the management of all cardiac arrest rhythms. As always, the provider should recall the H's and T's to identify a factor that may have caused the arrest or may be complicating the resuscitative effort. The most common causes of VF/pulseless VT are presented as H's and T's in the table below:

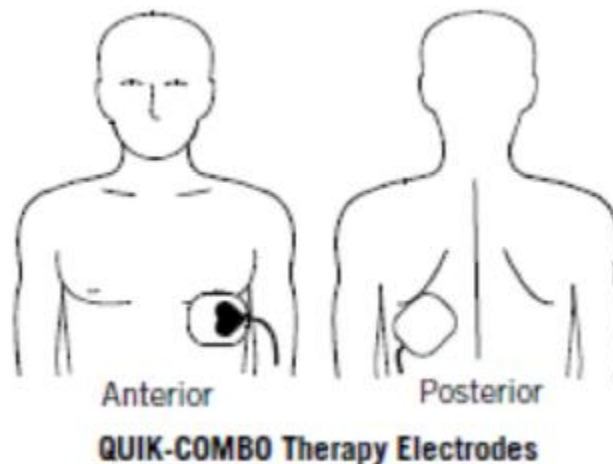
H's	T's
Hypovolemia	Tension Pneumothorax
Hypoxia	Tamponade (cardiac)
Hydrogen ion (acidosis)	Toxins
Hyper- / hypokalemia	Thrombosis (pulmonary)
Hypothermia	Thrombosis (coronary)

# Ventricular Fibrillation Pulseless Ventricular Tachycardia



Special Considerations (cont.),

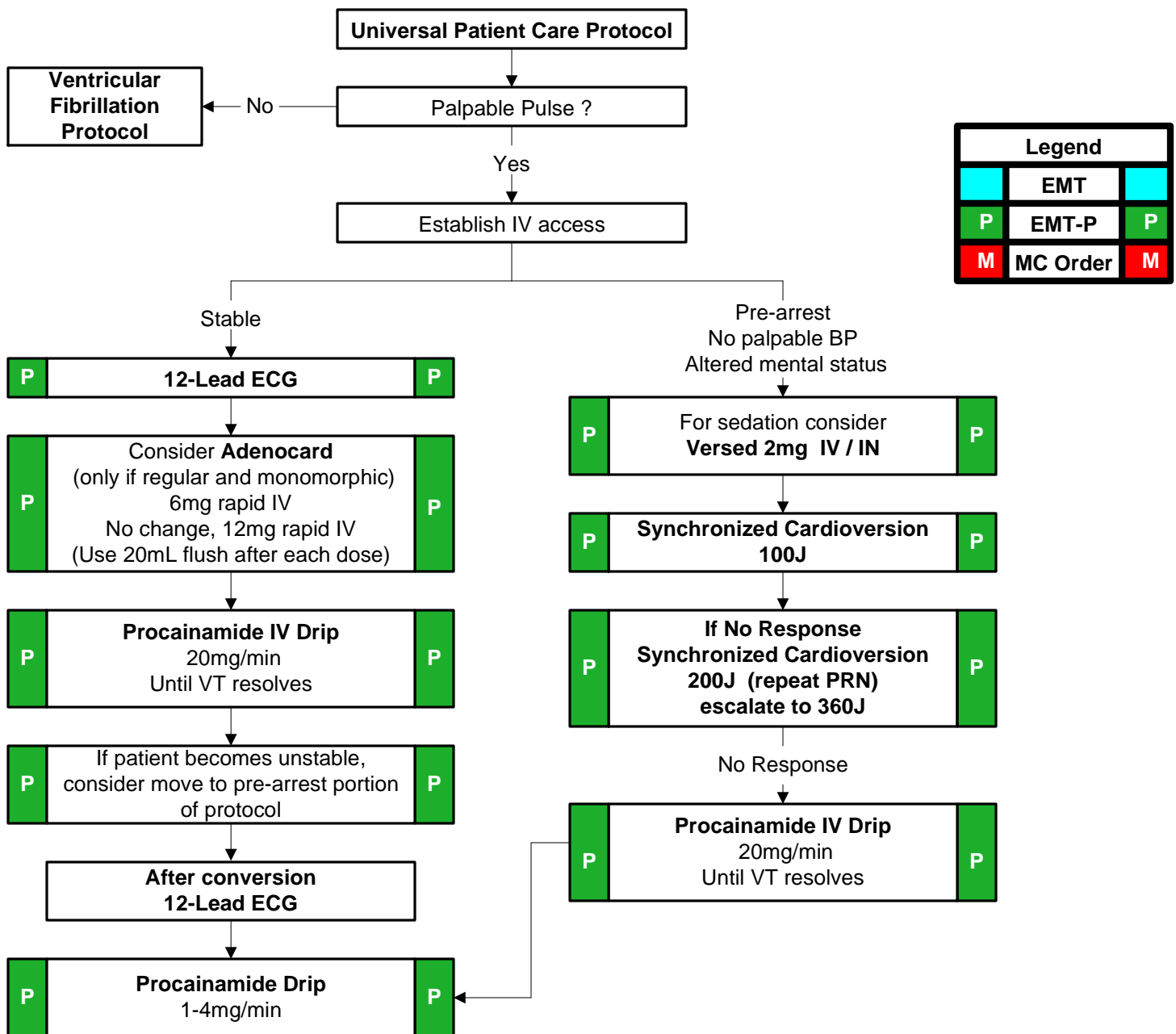
6. Polymorphic VT (Torsades de Pointes) may benefit from administration of Magnesium Sulfate. Administer 2Gms Magnesium Sulfate slow IVP for VF / VT refractory to initial defibrillations efforts and Amiodarone infusion.
7. Refractory / recurrent ventricular fibrillation/tachycardia is an arrhythmia not responsive to standard therapy techniques. It is initially managed by standard defibrillation, treating correctable causes and antiarrhythmic medications. If these methods fail to produce a response, anterior-posterior pad positioning should be used as an alternative position for defibrillation.
8. To perform anterior-posterior placement:
  - a. Place either the ♥ or + therapy electrode over the left precordium. The upper edge of the electrode should be below the nipple. Avoid placement over the nipple, the diaphragm, or the bony prominence of the sternum, if possible.
  - b. Place the other electrode behind the heart in the infrascapular area. For patient comfort, place the cable connection away from the spine. Do not place the electrode over the bony prominences of the spine or scapula.



# Q Ventricular Tachycardia / Wide Complex with Pulse



<b>History:</b> <ul style="list-style-type: none"> <li>• Past medical history / medications, diet, drugs</li> <li>• Syncope / near syncope</li> <li>• Palpitations</li> <li>• Pacemaker</li> <li>• Allergies: lidocaine / novacaine</li> </ul>	<b>Signs / Symptoms:</b> <ul style="list-style-type: none"> <li>• Ventricular Tachycardia on ECG (Runs or sustained)</li> <li>• Conscious, rapid pulse</li> <li>• Chest pain, shortness of breath</li> <li>• Dizziness</li> <li>• Rate usually 150-180 bpm for sustained V-Tach</li> <li>• <b>QRS &gt; 0.12 sec</b></li> </ul>	<b>Differential:</b> <ul style="list-style-type: none"> <li>• Artifact / Device failure</li> <li>• Cardiac</li> <li>• Endocrine / Metabolic</li> <li>• Hyperkalemia</li> <li>• Drugs</li> <li>• Pulmonary</li> </ul>
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\* If known or suspected WPW – DO NOT use Adenocard



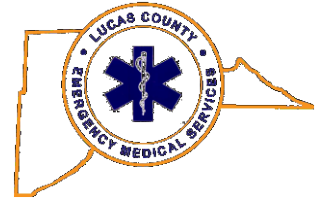
## Q Ventricular Tachycardia / Wide Complex with Pulse



### Special Considerations:

1. This protocol applies to the patient who is symptomatic due to Ventricular Tachycardia / Wide Complex with a pulse.
2. Ventricular Tachycardia / Wide Complex can be caused by many underlying factors. Consider the following possible causes and, if verified, render the appropriate treatment:
  - Hypovolemia
  - Hypoxia
  - Hydrogen Ion (Acidosis)
  - Hyper/Hypokalemia
  - Hypothermia
  - Hypoglycemia
  - Toxins (poisons, overdose)
  - Tamponade, Cardiac
  - Tension Pneumothorax
  - Thrombosis, Coronary/Pulmonary
3. For hemodynamically stable patients, attempt to acquire 12-Lead ECG prior to rhythm conversion.
4. Stable Ventricular Tachycardia / Wide Complex with a pulse may terminate with an increase in vagal tone. Have the patient cough several times in an attempt to terminate the arrhythmia.
5. If the rhythm etiology cannot be determined and is regular in its rate and monomorphic, recent evidence suggests that IV Adenocard is relatively safe for both treatment and diagnosis. Consider Adenocard (only if regular and monomorphic) 6mg rapid IV push. Give Adenocard rapidly over 1 to 3 seconds through a large (e.g., antecubital) vein followed by a 20mL saline flush. If the rate/rhythm does not convert within 1 to 2 minutes, administer Adenocard 12mg.  
**NOTE: If known or suspected WPW – do not administer Adenocard, proceed immediately to Procainamide infusion.**

## Q Ventricular Tachycardia / Wide Complex with Pulse



### Special Considerations (cont.),

6. For rate/rhythm that is refractory to Adenocard, administer Procainamide 20mg/min until the arrhythmia is suppressed, hypotension ensues, the QRS complex is prolonged by 50% from its original duration, or a total of 17mg/Kg of the drug has been given. Mix 1Gm Procainamide in a 50mL bag of D5W (20mg/mL). With (60gtt) administration set, run at 60gtts/min to achieve 20mg/min.
7. Rhythm termination with the use of Procainamide will require a maintenance infusion. Mix 1Gm Procainamide in a 250mL bag of D5W (4mg/mL). With (60gtt) administration set, run at 1-4mg/min:

**1mg/min = 15gtts/min**

**2mg/min = 30gtts/min**

**3mg/min = 45gtts/min**

**4mg/min = 60gtts/min**

8. Unstable ventricular tachycardia is defined as patients with signs and symptoms of altered mental status, low blood pressure, shock or AMI.
9. In the absence of hypotension, pulmonary edema, or unconsciousness, a precordial thump may be used prior to cardioversion.
10. Unstable Ventricular Tachycardia may require synchronized cardioversion starting at 100 Joules. Escalate as necessary for rhythm conversion (100J - 200J - 300J - 360J).
11. Patients requiring sedation prior to synchronized cardioversion should receive Versed 2mg slow IV. Absent IV access, consider administration of Versed 2mg IN.
  - If Versed allergy exists, consider analgesic administration as outlined in **Tab 900 Section T: Pain Management.**

# R

## 12-Lead ECG



Rapid diagnosis of acute myocardial infarction is essential for initiating appropriate treatment and improving outcomes. In selected practice environments, pre-hospital ECG's may facilitate emergency department treatment or may facilitate primary triage to appropriate cardiac care centers.

### Clinical Indications

- A. 12-Lead acquisition ***is mandated by the Lucas County EMS Medical Director*** on the following patients (if equipment available):
- Adults who access the emergency medical system with a complaint of non-traumatic, heart-related symptoms.
  - Persons who access the emergency medical system whom the paramedic suspects ACS (Acute Coronary Syndrome) for any reason.
  - Persons who access the emergency medical system and on whom a physician requests paramedics acquire a 12-Lead ECG for evaluation.
  - All patients with previous cardiac history.
  - All patients  $\geq 40$  years of age with a medical complaint.
- B. Criteria for exclusion of 12-Lead acquisition:
- A patient for whom the acquisition of a pre-hospital 12-Lead ECG will cause a significant time delay or other circumstance that is not in the best interest of patient care at that time.
  - A patient who refuses to allow a 12-Lead ECG to be performed.

### Procedure

1. Prep skin as time and patient condition allows:
  - a. Shave excess hair
  - b. Wipe electrode sites with alcohol
  - c. Dry skin with towel
2. Attach limb leads:
  - a. Right anterior axillary line – Right anterior shoulder (white lead)
  - b. Left anterior axillary line – Left anterior shoulder (black lead)
  - c. Right anterior superior iliac crest – Right hip (green lead)
  - d. Left anterior superior iliac crest – Left hip (red lead)



# R 12-Lead ECG



## 12 Lead ECG, continued

3. Attach precordial leads to patient's chest
  - a. V1 – fourth intercostal space at the right sternal border.
  - b. V2 – fourth intercostal space at the left sternal border.
  - c. V3 – directly between leads V2 and V4.
  - d. V4 – fifth intercostal space at midclavicular line.
  - e. V5 – level with V4 at the left anterior axillary line.
  - f. V6 – level with V5 at the left midaxillary line.
  - g. V4R – Same positioning as V4 on the right chest

### Lead “Views”

I (Lateral)	aVR	V1 (Septal)	V4 (Anterior)
II (Inferior)	aVL (Lateral)	V2 (Septal)	V5 (Lateral)
III (Inferior)	aVF (Inferior)	V3 (Anterior)	V6 (Lateral)

4. Instruct patient to remain still. 12-Lead acquisition time is approximately 10 seconds.
5. If STEMI suspected, assure transport to designated STEMI facility and transmit ECG to receiving hospital.
6. Document 12-Lead intervention, time and results in the patient care report (ePCR).

### Notes / Precautions

- When placing electrodes on female patients, always place leads V3-V6 under the breast rather than on the breast.
- Never use the nipples as a reference point for locating the electrodes on men or women because nipple locations may vary widely.



## R 12-Lead ECG



### 12 Lead ECG, continued

- If feasible, the 12-Lead ECG should be acquired with the patient in a supine position. Many cardiac patients may be unable to tolerate a supine position. In these situations, sitting or semi-sitting position is allowable.
- If defibrillation or synchronized cardioversion is required, quickly remove the necessary precordial leads to allow for quick-combo patch placement.
- A 12-Lead ECG with standard limb lead electrode placement will be performed on all eligible patients.
- 12-Lead interpretive findings should be reported to ***On-Line Medical Control*** during transmission of the patient assessment.
- Serial 12-Lead ECG's should be acquired every 5-10 minutes or with change in patient condition.
- Enter all pertinent patient data into the patient's LifePak record.
- All ECG data must be transferred/downloaded to the patient medical record (ePCR).



# S

## 12-Lead ECG Transmission



The 12-Lead ECG, when applied in the prehospital setting, has significant value for the patient with a suspected ACS. The potential effect on the patient includes both diagnostic and therapeutic issues, including the diagnosis of acute myocardial infarction (AMI) and the indication for acute reperfusion therapy. The prehospital ECG may also detect an ischemic change that has resolved with treatment delivered by EMS prior to the patient's arrival in the emergency department. The most significant issue in the management of ACS patients involves the effect of the out-of-hospital ECG on the ED-based delivery of reperfusion therapy. In AMI patients with ST-segment elevations, it has been conclusively demonstrated that information obtained from the prehospital ECG, and then transmitted to the receiving facility, reduces the time to hospital-based reperfusion treatment. Importantly, these benefits are encountered with little increase in EMS resource use or on-scene time.

### Clinical Indications:

- 12-Lead ECG's revealing "STEMI" (injury) patterns.
- 12-Lead's requested by ***On-Line Medical Control*** for physician over-read.

### Procedure:

1. Obtain 12-Lead ECG.
2. Assure the MultiTech modem is properly plugged in and has power.
3. Press **TRANSMIT**. The Transmit menu appears.
4. Use the **SPEED DIAL** to select the desired **REPORT** and **SITE**, if necessary.
5. Select **SEND**. The patient report is transmitted. The status of the transmission appears in the message area.
6. Whenever your attempt to transmit a record, a transmission report is automatically printed at the completion of the transmission attempt. The transmission report indicates the date and time of the transmission attempt and the final status of the transmission.



# S 12-Lead ECG Transmission



12-Lead Transmission, continued

7. You can cancel a transmission that is in process. To cancel a transmission, select **CANCEL** on the Transmit menu if you are transmitting a current record, or select **CANCEL** on the Options/Archives/Send Data Menu if you are transmitting from an archived record.



# T Automated Implantable Cardioverter-Defibrillator (AICD)



An automated implantable cardioverter-defibrillator (AICD) is a small battery-powered electrical impulse generator which is implanted in patients who are at risk of sudden cardiac death due to ventricular fibrillation. The device is programmed to detect cardiac arrhythmia and correct it by delivering a jolt of electricity. In current variants, the ability to revert ventricular fibrillation has been extended to include both atrial and ventricular arrhythmias as well as the ability to perform biventricular pacing in patients with congestive heart failure or bradycardia.

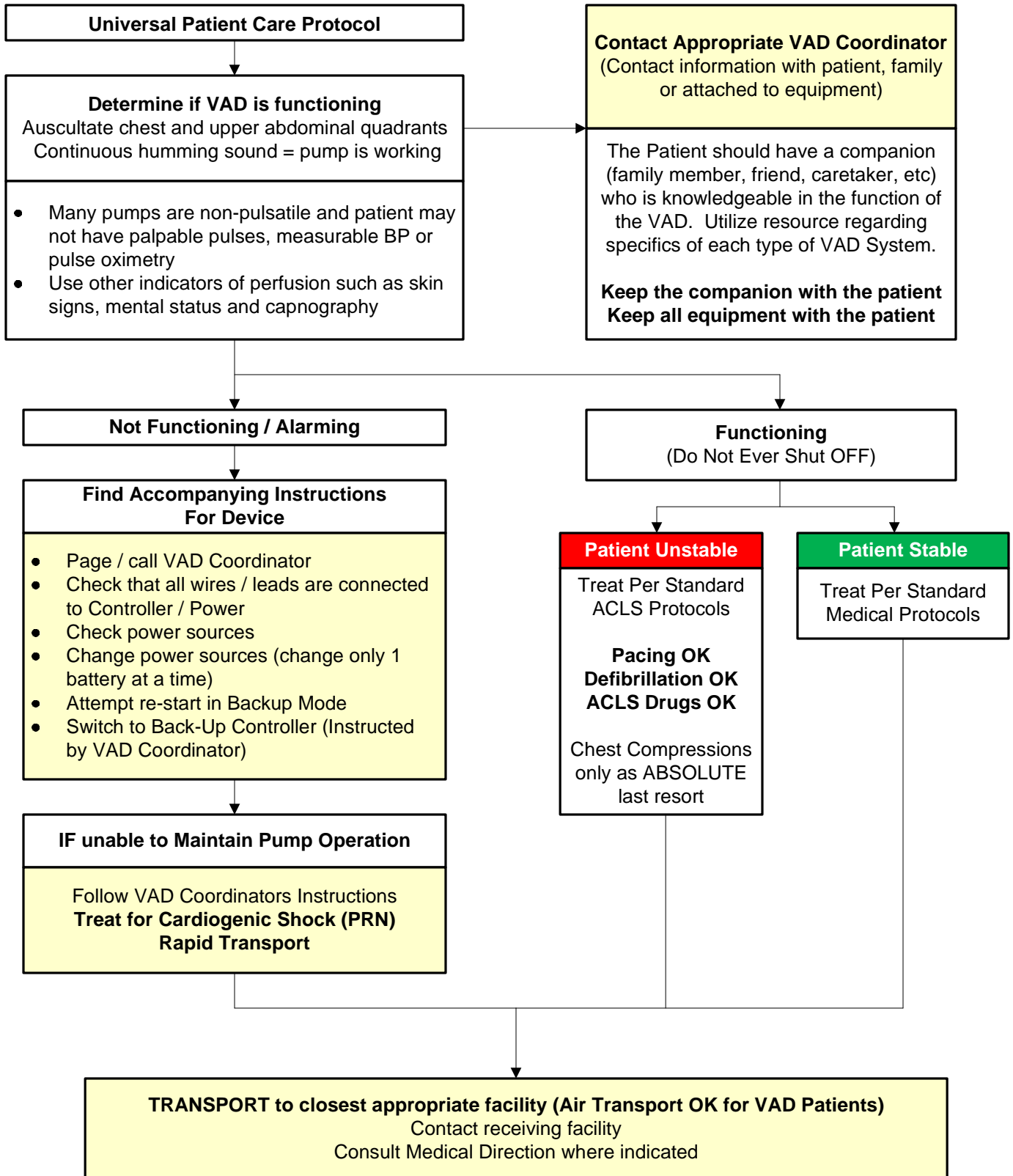
The process of implantation of an ICD is similar to implantation of a pacemaker. Similar to pacemakers, these devices typically include electrode wire(s) which pass through a vein to the right chambers of the heart, usually being lodged in the apex of the right ventricle.

ICD's constantly monitor the rate and rhythm of the heart and can deliver therapies, by way of an electrical shock, when the electrical manifestations of the heart activity exceed the preset number. More modern devices can distinguish between ventricular fibrillation and ventricular tachycardia.

## Guidelines for Assessment / Treatment:

- A. Patients reporting a "discharge" of their AICD should be transported by Life Squad. For recurrent arrhythmia, follow the appropriate protocol. The patient's AICD may charge and subsequently discharge in an attempt to terminate the abnormal rhythm.
- B. For patients who present in cardiac arrest, it is safe and appropriate to start CPR. Most ICDs have the ability to "fire" 3-4 times in response to refractory V-Fib/Pulseless V-Tach if no intervening organized cardiac activity is monitored.
- C. Follow standard LCEMS Protocols for cardiac arrest interventions. For recurrent VF/VT, all defibrillations should be performed at the maximum joule setting (360J). Avoid combo-patch placement over the ICD. If external defibrillation is unsuccessful, attempt change in combo-patch placement (i.e., anterior/posterior; reverse polarity-antero/lateral chest)

# U Ventricular Assist Devices (LVAD, RVAD, BiVAD)



# U Ventricular Assist Devices

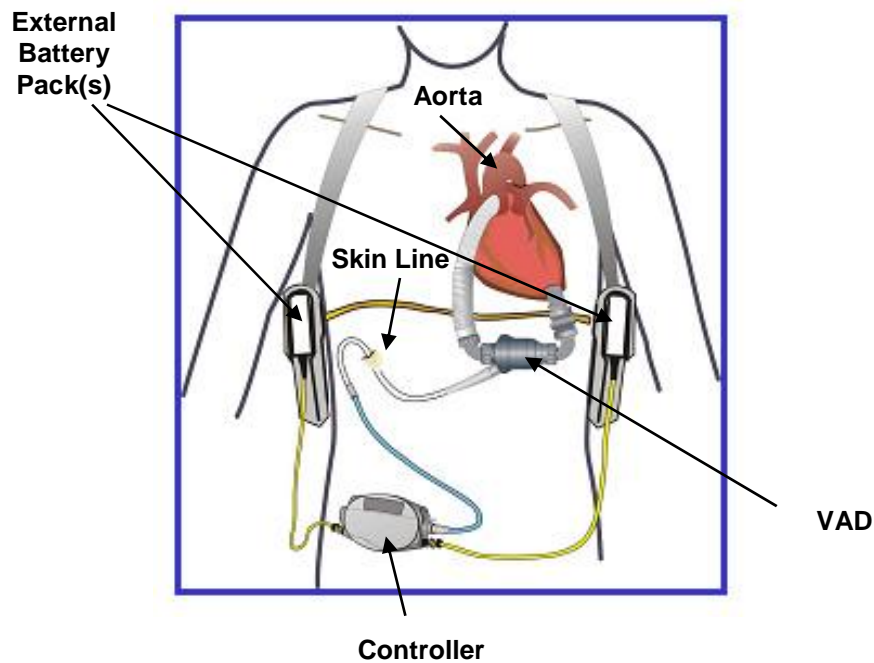


Ventricular Assist Devices or “heart pumps” help circulate blood in patients with advanced heart failure. Ventricular Assist Devices are attached to the existing heart and provide continuous blood flow. Therefore, it may be extremely difficult to feel a pulse.

Ventricular Assist Devices run on electricity provided by either a Power Base Unit (PBU) during stationary use, or by rechargeable batteries that are worn during mobile use.

Blood flow through the Ventricular Assist Device follows the native cardiac cycle and will vary during diastole and systole. Therefore, it is essentially synchronized with the mechanical activity of the native heart.

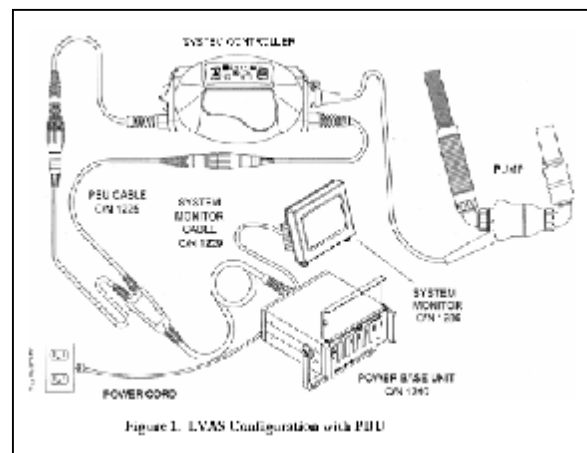
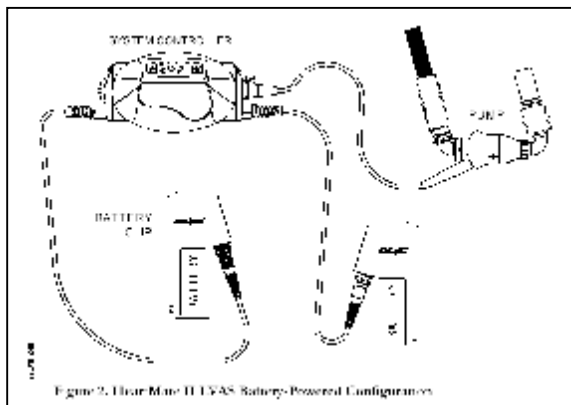
The Ventricular Assist system is a life-sustaining device. In the event that it stops operating, all attempts should be made to restore pump function immediately. Place hand on patient’s abdomen to feel if the VAD is operating. If VAD operation cannot be felt, a stethoscope may be used to auscultate over the device to verify that it is running. When working, the device makes a quiet whirling sound.



Ventricular Assist Devices (cont.),

**System Components:**

- System Controller
- Power Base Unit (PBU) and PBU cable
- Batteries and battery clips
- Emergency Power Pack (EPP)
- System Monitor
- Display Module



**Precautions / Warnings Specific to Patient or System Management**

- The VAD should NOT be disconnected during external defibrillation or cardioversion.
- In the event that the VAD stops operating, attempt to restore pump function immediately. In the event that the VAD stops operating and blood is stagnant in the pump for more than a few minutes, there is a risk of stroke or thromboembolism should the device be restarted. There is also a risk for retrograde flow within the VAD.
- Disconnecting both System Controller power leads at the same time will result in loss of pump function. One System Controller power lead must be connected to a power source (i.e., batteries, PBU, or EPP) at all times to maintain support.



# U

## Ventricular Assist Devices



### Ventricular Assist Devices (cont.),

- D. Avoid unnecessary pulling or moving of the external portion of the percutaneous lead, especially as the exit site is healing.
- E. **The use of automated blood pressure monitoring devices may not yield accurate blood pressure data.** Manual auscultation to assess blood pressure is recommended. In circumstances where the flow is not sufficient for auscultation, Doppler or invasive blood pressure monitoring may be required.

### Precautions / Warning Specific to EMS Assessment and Treatment

- A. A life squad will automatically be dispatched for any patient with a Ventricular Assist Device.
- B. VAD patients will pose a challenge in the approach to assessment and treatment. Life squad transport is strongly encouraged for an ill patient even with normal VAD function. These patients are very prone to illness and infection.
- C. Peripheral pulses may be absent with normal VAD function and blood pressures may be unobtainable. Assessment must be based upon overall patient presentation including respiratory status, skin color and temperature, mentation, ECG findings and capnography.
- D. In the event of cardiac arrest, external chest compressions pose a potential risk to the location of the outflow graft on the aorta and the inflow conduit in the left ventricular apex. Patients who present in cardiac arrest with a functioning VAD unit should have CPR performed only if absolutely necessary. VAD function can be assessed by placing a stethoscope over the device and listening for a whirling sound. All other standard therapies should be rendered as per protocol (i.e., airway control, defibrillation, medication administration). ***CPR should be considered as a last-saving effort when the VAD device has failed.***
- E. The VAD System Controller has a number of “advisory” and “hazard” alarms that may have to be addressed for optimal VAD function. Rely on the patient or family member’s familiar with the device to troubleshoot the operation. Patients and family members have been educated in the function of the VAD.



# U Ventricular Assist Devices



Ventricular Assist Devices (cont.),

- F. VAD patients known to Lucas County EMS have had premise history information added into the CAD system. Responding life squads will have access to this information from the Mobile Data Terminals (MDT's). Premise history will contain important patient information and emergency contact numbers that can be accessed from the scene to assist with patient management.
- G. Utilizing the emergency contact information supplied, paramedics are encouraged to contact the VAD specialists for questions related to VAD function, power management, alarms, device management or patient assessment and treatment.