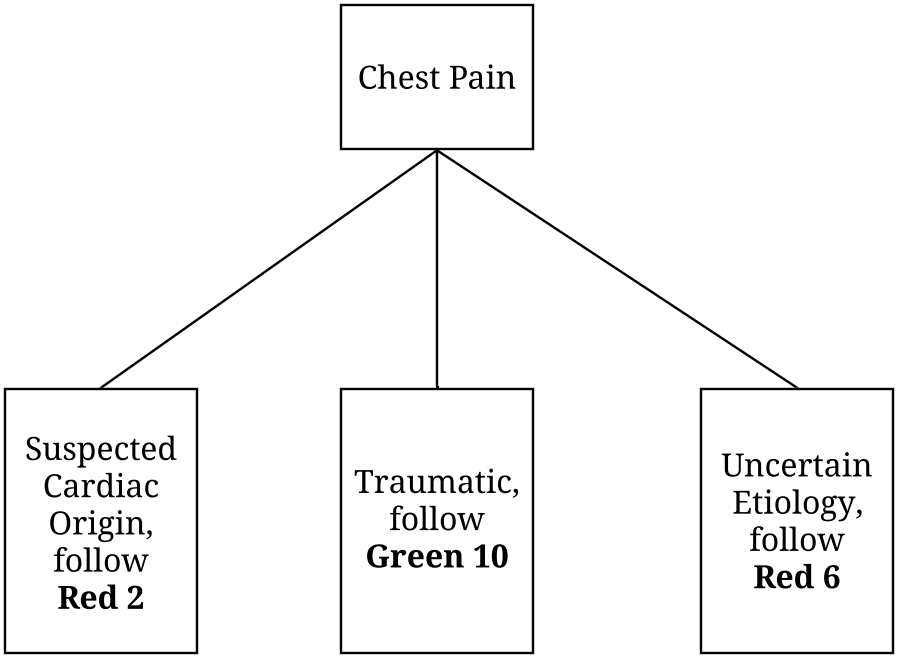
Chest Pain - General

For all patients with chest pain, evaluation for acute coronary syndrome should occur. Commonly, it is difficult with the tools available to EMS providers to completely rule out a cardiac cause of chest pain. Therefore, all patients should be transported for emergency medical evaluation. Cardiac disease is but one of the many causes of chest pain and the EMS provider should consider various causes such as esophageal, chest wall, pulmonary embolism, aortic dissection, spontaneous pneumothorax, etc. Patients commonly fall into one of three categories: suspected cardiac, traumatic, or uncertain cause of chest pain.

*****The cardiac monitor/defibrillator should be brought to the patient's side during the initial assessment. *****



Consider cardiac origin chest pain in the following:

- Chest pain or discomfort in other areas of the body (i.e. arm, jaw, epigastrium), shortness of breath, sweating, nausea, vomiting and dizziness.
- Atypical or unusual symptoms are more common in women, the elderly and diabetic patients. May also present with CHF, syncope and/or shock.

Chest Pain - Suspected Cardiac Origin #1

- Avoid nitroglycerin in any patient who has used a phosphodiesterase inhibitor within the past 48 hours. Examples are:
  - sildenafil (Viagra, Revatio), vardenafil (Levitra, Staxyn), tadalafil (Cialis, Adcirca) which are used for erectile dysfunction and pulmonary hypertension.
  - epoprostenol (Flolan) or treprostinil (Remodulin) which are used for pulmonary hypertension.
- Administer nitrates with caution as hypotension can occur in *any* patient having an MI.

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EMT

1. Administer O_2 to keep O_2 sats greater than or equal to 94% and less than 99% (avoid hypo/hyperoxia)
2. Treat for shock if indicated
3. Request ALS
4. If patient has not taken an aspirin, administer chewable aspirin 324 mg **PO**, if not contraindicated by allergy
5. If available and so trained, perform 12 lead ECG. EMT's are not certified to interpret the 12-lead ECG or change the ALS response based on obtaining a 12-lead ECG. The purpose of the EMT in obtaining the 12-lead ECG is to present it to the Paramedic and/or receiving facility.

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6. Contact OLMC for the OPTION of assisting with the administration of patient's own nitroglycerin

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ADVANCED EMT

7. IV en route
8. Cardiac monitor and 12-lead ECG within the first 10 minutes of patient contact, if so trained (AEMTs are not certified to interpret the 12-lead ECG or change the ALS response based on obtaining a 12-lead ECG. The purpose of the AEMT in obtaining the ECG is to present it to the Paramedic and/or receiving facility)

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9. Contact OLMC for administration of nitroglycerin 0.4 mg tab **SL** or 1 **SL** spray. May repeat two times at 5 minute intervals if BP is greater than 100 mmHg. If the patient has had nitroglycerin before and no IV is established, and systolic BP is greater than 100 mmHg, then it is OK to give nitroglycerin

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PARAMEDIC

10. Paramedic may perform all treatments above without medical control
11. Obtain 12-lead ECG within first 10 minutes of patient contact

If patient meets **STEMI** criteria, refer to local or regional cardiac systems of care for destination decision support and contact OLMC at receiving hospital to alert of impending arrival (local hospital notification) and go to **Red 3**.

Apply defib pads and be prepared to defibrillate as these patients are high risk for VF/VT

(Continued)

PARAMEDIC (cont)

12. Patients who present with inferior MI, clear lung sounds, and BP less than 90 mmHg, give fluid bolus.

13. Consider
    a. Additional nitroglycerin
    b. Fentanyl 1 mcg/kg **IV**/**IM**, or **IN** to a MAX dose of 100 mcgs
    c. Additional fluid bolus in patients with inferior MI

14. If patient develops a dysrhythmia, refer to appropriate protocol

Inferior MIs and right-sided MIs are commonly associated with bradycardia and blocks.

Hypotension may occur in any MI, not just inferior MIs with right ventricular involvement.

STEMI Criteria

1. Septal (V1, V2), Anterior (V3, V4) , Inferior (II, III, aVF) or Lateral MI (I, aVL, V5, V6): ST elevation greater than 1 mm in two or more anatomically contiguous leads with reciprocal changes.

2. For leads V2-V3, the criteria for STEMI are:
   2 mm - Males 40 yo and older
   2.5 mm - Males younger than 40 yo
   1.5 mm for Women independent of age

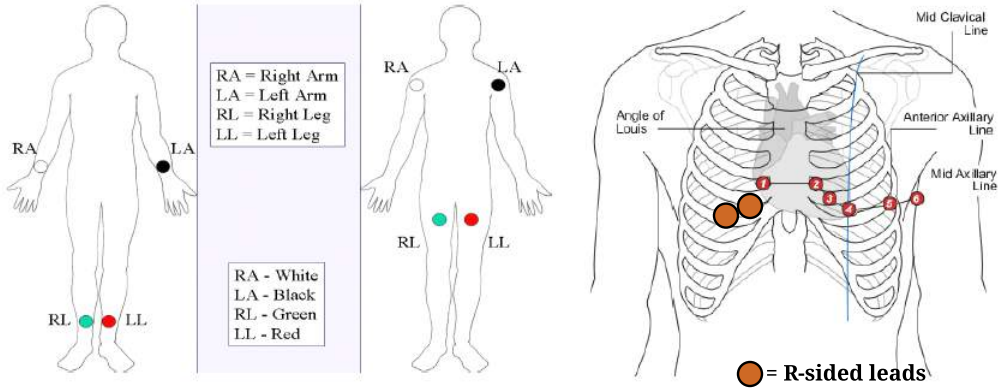
3. Posterior MI: ST depression greater than 1 mm in V1, V2 (and possibly V3) with an R/S ratio of greater than or equal to 1, place posterior leads to evaluate for ST segment elevation in leads V7/V8/V9

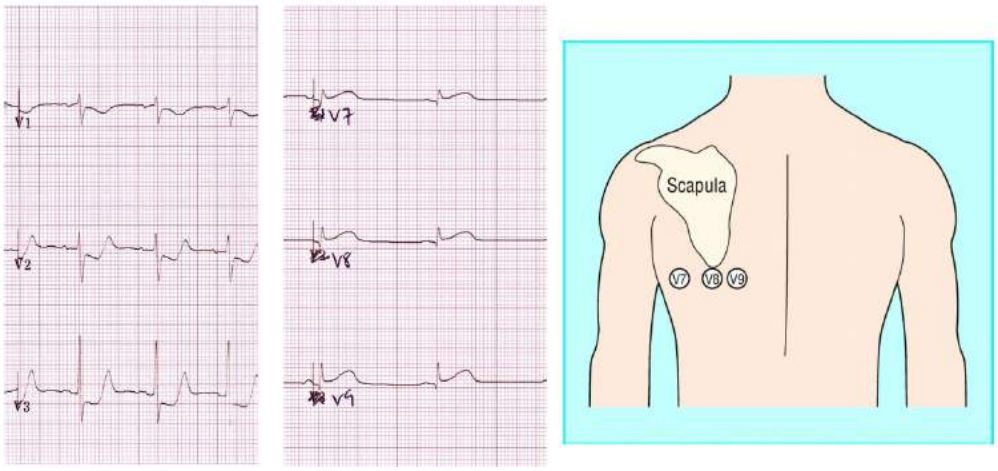
New LBBB is no longer a criteria for STEMI
(Presence of any LBBB makes the diagnosis of STEMI difficult)

1. Prehospital 12-lead ECG is now a standard of care for increasing diagnostic information regarding the chest pain/cardiac arrest patient
2. Acquisition of a 12-lead ECG should be done in all patients with chest pain or a potential cardiac complaint/diagnosis such as syncope or shortness of breath. Given the frequency of atypical presentation in the elderly, responders must have a high index of suspicion in the elderly patient
3. Transmission of 12-lead ECG or presentation of prehospital 12-lead ECG to treating providers at the receiving ED is intended to augment patient triage and facilitate rapid identification of a potential thrombolytic or emergent catheterization candidate
4. In the case of STEMI, notify the receiving ED immediately

*****Advanced EMT and the Use of 12-lead ECGs*****

AEMTs are not certified to interpret the 12-lead ECG or change the ALS response based on obtaining the 12-lead ECG. The purpose of the AEMT in obtaining the 12-lead ECG is to present it to the Paramedic and/or receiving facility.





Consider Posterior Leads for suspected posterior MI

Chest Pain Fibrinolytic Checklist

For chest pain of suspected cardiac origin, initiate therapy per protocol, including the early use of aspirin and nitroglycerin, if not contraindicated.

Use this checklist, or local equivalent, if available.

Report the information as soon as practical to the receiving ED.

You may copy and use this page as your checklist, or you may use a checklist recommended by your usual receiving hospital which contains at least these questions.

*****Please follow your destination institution's STEMI Checklist*****

Has pain persisted for greater than 15 min and less than 12 hours?	**YES**	NO
Is systolic BP less than 180 mmHg?	**YES**	NO
Is diastolic BP less than 100 mmHg?	**YES**	NO
History of structural CNS disease (i.e. AV malformation)	YES	**NO**
Significant closed head/facial trauma within previous 3 months?	YES	**NO**
Surgery or major trauma, GI/GU bleed in previous 2 weeks?	YES	**NO**
Any history of intracranial hemorrhage?	YES	**NO**
Any bleeding, clotting problem, or blood thinners?	YES	**NO**
Pregnant?	YES	**NO**
Serious systemic disease (i.e. advanced cancer, severe liver or kidney disease?)	YES	**NO**

Chest Pain - Uncertain Etiology

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For ALL patients with chest pain, consider the possibility of cardiac disease no matter what the history and physical suggest. However, there are other sources of non-cardiac chest pain to consider such as pulmonary embolism, spontaneous pneumothorax, aortic dissection/aneurysm, esophageal, chest wall, etc.

If trauma suspected, refer to the Chest Trauma protocol, **Green 10.**

EMT:

1. Administer O_2 only to patients with dyspnea, hypoxia (SpO_2 less than 94%) or signs of heart failure at a rate to keep O_2 sats greater than or equal to 94% and less than 99% (avoid hyperoxia)
2. Transport in position of comfort
3. Request ALS
4. If available and so trained, perform 12 lead ECG. EMT's are not certified to interpret the 12-lead ECG or change the ALS response based on obtaining a 12-lead ECG. The purpose of the EMT in obtaining the 12-lead ECG is to present it to the Paramedic and/or receiving facility.

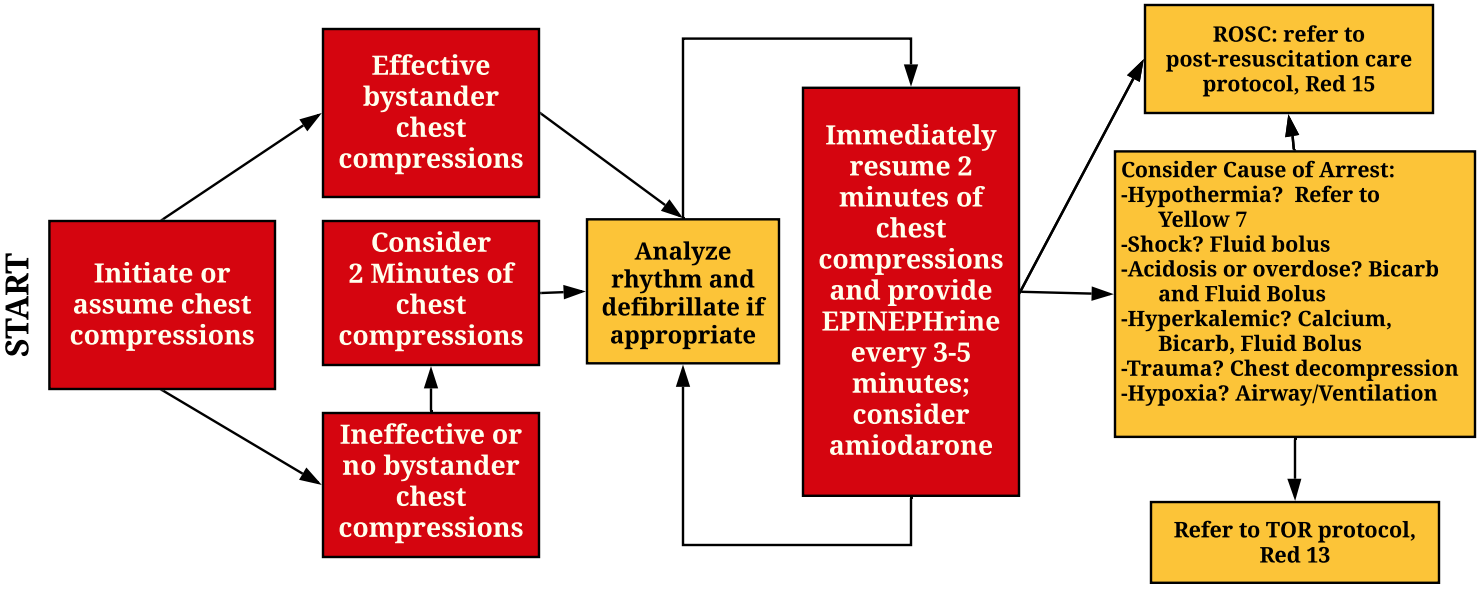
ADVANCED EMT

5. Establish IV at TKO
6. Request Paramedic
7. Cardiac monitor and 12-lead ECG (AEMTs are not certified to interpret the 12-lead ECG or change the ALS response based on obtaining a 12-lead ECG. The purpose of the AEMT in obtaining the 12-lead ECG is to present it to the Paramedic and/or receiving facility)

PARAMEDIC

7. If 12-lead ECG indicates STEMI, refer to **Red 2 & 3**
8. For chest pain in a stable patient with normal level of consciousness, refer to the Universal Pain Management protocol, **Green 17** for analgesia options
9. For nausea and vomiting, refer to the Nausea and Vomiting protocol, **Gold 19**

Cardiac Arrest Overview



Manage airway as appropriate. Consider basic measures first OR advanced airway without interruption of chest compressions.

CARDIAC ARREST CHECKLIST	
	Code leader and roles identified (pre-arrival)
	Continuous chest compressions with minimal interruption (compress while defib charging) and full recoil
	Turn on CPR feedback device/metronome with goal of 100-120 compressions/minute
	Rotate compressors at least every 2 minutes
	AED/Defib applied and monitored
	O_2 flowing and attached to NR/BVM
	$ETCO_2$ waveform present & monitored
	IV/IO established
	Possible causes considered
	Consult OLMC **early** to discuss complex cases
	Gastric insufflation limited and gastric decompression considered
	Family present and ongoing communication/support provided

Evaluate for all potential causes of cardiac arrest, including the 5 **H's** (**H**ypothermia, **H**ypovolemia, **H**ypoxia, **H**ypo/**H**yperkalemia, **H**+ ion or acidosis) and the 5 **T's** (Cardiac **T**amponade, **T**ension Pneumothorax, **T**hromboembolic disease x 2 (i.e.pulmonary embolism/MI) and **T**oxins). Prior to termination of cardiac arrest, address potential causes of arrest, including effective management of patient airway, provision of fluid bolus, and consideration of bicarb in possible toxic or acidotic. Also, consider bicarb and calcium in suspected hyperkalemic patients. Please note, patients on dialysis are at risk for electrolyte abnormalities. Finally, consider needle decompression for tension pneumothorax if appropriate.

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EMT

1. Initiate CPR until AED arrives unless valid DNR or signs incompatible with life are present; refer to Termination of Resuscitation protocol, **Red 13**
2. Attach AED as soon as available with minimal interruptions in chest compressions and follow AED prompts
3. Place oral and/or nasal airway(s)
4. High-flow O_2 with BVM ventilation at a ratio of 30:2 or 1 breath every 10 chest compressions during recoil and without interrupting compressions
5. Request ALS
6. Continue 2-minute cycles of chest compressions and AED checks
7. If ROSC occurs, refer to Adult Post-Resuscitation Care protocol, **Red 15**
8. Consider termination of resuscitation; refer to **Red 13**

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ADVANCED EMT

9. Establish **IV/IO** without interrupting chest compressions
10. Manage the airway per **Blue 3**. Avoid respiratory rate greater than 10/minute in cardiac arrest
11. Defibrillate as indicated

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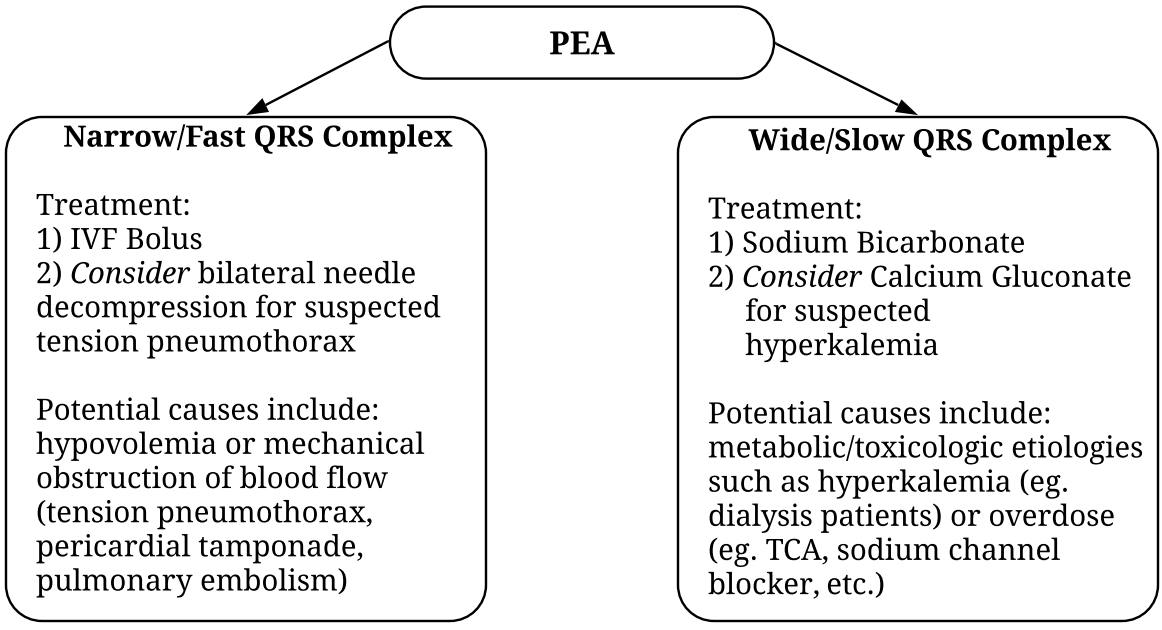
PARAMEDIC

12. One medication intervention at each 2-minute reassessment per ACLS protocol
13. EPINEPHrine 1 mg of 1 mg/10 mL (1:10,000) **IV/IO** push every 3-5 minutes
    NOTE: For **Pediatric** Medication doses, see Red 12

    a. VF/VT: amiodarone 300 mg **IV/IO** push; may consider additional 150 mg **IV/IO** one time
    b. Torsades: 2 grams of magnesium sulfate **IV/IO**
    c. For refractory VF/VT (total of ~~5~~ 3 shocks, dose of EPINEPHrine and amiodarone), refer to Refractory VF/VT protocol, **Red 12**
    d. For PEA, in addition to standard therapies, consider treatment based on



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Cardiac Arrest #2

Continued from previous page:

14. Consider causes of OHCA. Consult OLMC early for questions/advice.
    a. Is patient on dialysis, have known renal disease or suspicion for hyperkalemia?
        i. Calcium gluconate 3 gram bolus IV/IO
        ii. Sodium bicarbonate 50 mEq bolus **IV/IO**; may repeat x 2
        iii. IV fluid bolus
    b. Is patient suspected TCA or other suspected sodium channel blocker overdose? **(See Pearls)**
        i. Sodium bicarbonate 50 mEq bolus **IV/IO**; may repeat x 2
        ii. IV fluid bolus
    c. Is there a suspected pre-existing metabolic acidosis? **(See Pearls)**
        i. Sodium bicarbonate 50 mEq bolus **IV/IO**; may repeat x 2
        ii. IV fluid bolus
    d. Is hypovolemia suspected? If yes, give fluid bolus
    e. Is hypoxia suspected? If yes, administer high-flow oxygen and manage airway per **Blue 3**
    f. Do you suspect a pneumothorax? If yes, perform needle decompression
    g. Is patient's core temperature less than 30°C (86°F) and circumstances consistent with hypothermia? If yes, see Hypothermia #2 protocol, **Yellow 8**
15. Upon ROSC:
    a. Refer to Adult Post-Resuscitation Care protocol, **Red 15**
    b. Contact OLMC for options of:

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i. Post-resuscitation amiodarone bolus

Pearls for Cardiac Arrest:
Effective chest compressions and defibrillation are the most important therapies for the patient in cardiac arrest. Effective chest compressions are defined as:

a. A rate of 100 - 120 compressions/minute
b. Depth of between 2 - 2.5 inches
c. Allow for complete chest recoil
d. Minimize interruptions in compressions
e. Rotate rescuers every 2 minutes
f. Avoid respiratory rate greater than 10/min
g. Quantitative end-tidal CO_2 should be used to monitor effectiveness of chest compressions. If $ETCO_2$ is < 10 mmHg, attempt to improve chest compression quality
h. Consider additional monitoring with biometric feedback

Resuscitate on scene as the effectiveness of chest compressions decreases during any patient movement. Resuscitation on scene should be the goal, with the only exceptions being safety concerns for the responding crew OR inability to effectively resuscitate in the patient's current location.

Pearls for Cardiac Arrest, continued:

All services MUST have an organized and structured response to the care of patients in cardiac arrest. This approach must be pre-arranged and may be modeled on the Maine EMS ICS for OHCA Program or other well-accepted structured approach to patient care. Also, EMS services are encouraged to train providers to these systems of care and to regularly train providers in high-performance CPR.

Use capnography during resuscitation for confirmation and monitoring of advanced airways and for prolonged use of BVM as well as monitoring effectiveness of chest compression and return or loss of spontaneous circulation.

Note: The algorithms for cardiac arrest or arrhythmias reflect the MEMS Medical Direction and Practices Board's interpretation of ACLS guidelines, as they should be used in the prehospital setting.

In OHCA patients consider humeral head placement preferentially due to proximity to central circulation.

Classes of common sodium channel blockers include the following:

- Antidepressants (amitriptyline, nortriptyline, imipramine, doxepin)
- Antiarrhythmics (quinine/quinidine, propafenone, flecainide)
- Anesthetics (cocaine, lidocaine, bupivacaine)
- Muscle Relaxants (cyclobenzaprine)
- Antihistamines (diphenhydramine)

Consider metabolic acidosis as the cause of cardiac arrest in the following clinical settings: aspirin overdose, severe diabetic ketoacidosis, severe sepsis, and excited delirium.

In the case of peripartum cardiac arrest, provision of high-quality CPR remains a priority. If a patient's fundus height is at or above the level of the umbilicus, manual uterine displacement to either the left or right is the preferred method of relieving aortocaval compression during chest compressions. Additionally, local hospital resources for advanced care should be activated immediately upon recognition of peripartum cardiac arrest. Contact OLMC to discuss the potential of additional therapies.

Pediatric cardiac dysfunction is usually due to a respiratory cause and is thus more likely to initially respond to effective oxygenation and ventilation followed by fluid administration and then medications. Defibrillation alone is rarely successful.

It is also prudent to consider foreign body airway obstructions given the age of the patient.

Cardiac Arrest #4 (Mechanical CPR Devices)

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1) Mechanical CPR (mCPR) devices are not mandatory devices, but may play a role in three prehospital cardiac arrest settings, including:
   a) Resuscitation events with few numbers of rescuers,
   b) Resuscitation events that are prolonged,
   c) Resuscitation events occurring during transport.
2) Manual CPR **MUST** remain the FIRST strategy for chest compressions as manual CPR is the most readily available and effective compression strategy in the vast majority of cases.
3) If applied, a mCPR device should be placed in a manner which minimizes interruptions, keeping all breaks in CPR to less than 10 seconds.
4) Application Process -- Upon encountering a patient in cardiac arrest:
   a. Initiate manual CPR
   b. Continue manual CPR for a minimum of 2 two-minute cycles. Placement or implementation of mechanical CPR may not begin until AFTER the 2nd cycle of CPR.
   c. If the responding EMS service chooses to implement mechanical CPR, placement may begin AFTER the second cycle of CPR and must be applied in a manner that coordinates with pulse/rhythm checks AND keeps all breaks in CPR to less than 10 seconds.
   d. Apply the device in accordance to manufacturer's instructions.
   e. It is possible that application of the device, in a manner that is coordinated with pulse/rhythm checks and maintains interruptions in CPR less than 10 seconds, may take an additional 2 or more cycles of CPR, leading to initiation of mechanical CPR after the 4th round of manual CPR.
5) Contraindications to Mechanical CPR
   a. Age less than 18.
   b. Patients who are unable to fit into the device due to body habitus.
6) In addition to the above, mechanical CPR devices may be placed prior to transport in patients that have recently achieved ROSC in the event of rearrest. The device should be in "stand-by" mode and activated if patient re-arrests en route to the hospital.
7) All Maine EMS Providers should be trained in High Performance CPR and Incident Command for Cardiac Arrest.
8) Mechanical CPR devices should ONLY be used by providers who have been trained to use the devices and can apply the devices while maintaining all breaks in CPR to 10 seconds or less.
9) Additionally, Maine EMS Providers should routinely practice High Performance CPR, Incident Command for Cardiac Arrest and, if the service chooses, placement and use of mechanical CPR devices. The frequency of such training is difficult for the MDPB to determine for each individual service. Ultimately, this number will be determined by multiple factors, including the size of the service and the service's annual number of resuscitation attempts. As a guide, some of the EMS services with the highest survival from witnessed VF arrest perform resuscitation training (including high performance CPR and ICS for cardiac arrest) 2-4 times a year. Please consult with your service medical director and QI program to assist in determining the proper frequency of trainings for your service.

Pediatric Cardiac Medications & Dosages

Prehospital providers should consider patient age, diagnosis, transport time, provider experience, and effectiveness of ongoing bag-valve-mask ventilation in considering whether to continue with bag-valve-mask ventilation versus proceeding to endotracheal intubation. Bag-valve-mask ventilation has been shown to be equivalent to endotracheal ventilation in pediatric patients in most situations with short transport times.

Atropine 0.02 mg/kg (Indication: Bradycardia)	**IV/IO**: Minimum dose: 0.1 mg MAX single dose: 0.5 mg (child), may repeat once
EPINEPHrine: 1 mg/10 mL (Indication: Bradycardia)	**IV/IO**: 0.01 mg/kg (0.1 mL/kg) to a MAX single dose of 1 mg
EPINEPHrine: 1 mg/10 mL (Indication: Asystole/Pulseless Arrest)	**IV/IO**: 0.01 mg/kg (0.1 mL/kg) to a MAX single dose of 1 mg Repeat every 3-5 minutes
Amiodarone (Indication: VF/VT)	5 mg/kg **IV/IO** Bolus: can repeat up to total dose of 15 mg/kg. MAX single dose: 300 mg
Sodium Bicarbonate (Indications: wide complex PEA suggesting hyperkalemia or sodium channel blocker overdose) Common sodium channel blockers include: tegretol, carbamazepine, TCA's, propranolol, and flecanide	**IV/IO**: 1 to 2 mEq/kg bolus MAX single dose: 50 mEq, repeat every 5 minutes until QRS duration less than 120 msec
Magnesium (Indication: Torsades de Pointes, moderate/severe asthma)	**IV/IO**: 25-50 mg/kg MAX single dose: 2 g

Synchronized Cardioversion: 0.5 - 1.0 J/kg (initial); 2 J/kg (subsequent)
Defibrillation: 2 J/kg (initial); 4 J/kg ; 6 J/kg; 10 J/kg (maximum)

Refractory VF/VT

- **Recurrent VF/VT** is defined as SUCCESSFULLY CONVERTED by standard defibrillation techniques but subsequently returns. It should NOT be treated by dual sequential defibrillation (DSD). It is managed by treatment of correctable causes and use of anti-arrhythmic medications in addition to standard defibrillation.
- **Refractory VF/VT** is defined as NOT CONVERTED by standard defibrillation. It is initially managed by treating correctable causes with anti-arrhythmic medications. If these methods fail to produce a response, the below therapies may be beneficial.

Refractory VF/VT after 3 unsuccessful shocks and administration of EPINEPHrine and amiodarone, consider the following steps:

1. Vector Change: apply a second set of pads. If first set was in the anterior-apex position (blue pads in figure), place a second set in the anterior-posterior position (red pads). Do not allow the pads to touch one another.
2. Ensure adequate pad contact: i.e. pressure on pads with a barrier such as a stack of folded towels. Reassess for adequate pad contact before each defibillation.
3. If the above steps fail to convert to sinus rhythm, consider dual-sequential external defibrillation.
   a. This can only be performed with MANUAL defibrillators.

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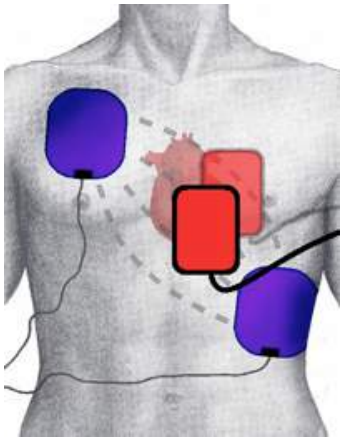
******Check with the manufacturers of your manual defibrillators re: the warranty if used in dual-sequential external defibrillation******

   b. Assure that controls for the second manual defibrillator are accessible to the team leader
   c. Verify that both cardiac manual defibrillators are attached to the patient, that all pads are well-adhered, and simultaneously charge both manual defibrillators
   d. When both defibrillators are charged to maximum energy settings and all persons are clear, push one shock button followed by the other immediately after the first shock is delivered.
   e. May repeat procedure every 2 minutes as indicated if refractory VF/VT persists



Termination of Resuscitation #1

Resuscitation should be **withheld** under the following circumstances:

- When it is found that the patient has a DNR order or other actionable medical order (i.e. POLST/MOLST form, etc.)
- Scene Safety: the physical environment is not safe for the provider(s)
- When irreversible signs of death, such as rigor mortis, dependent lividity, decapitation, decomposition, incineration, other obvious lethal injuries are present.
- When down time has been unknown or greater than 20 minutes with no bystander CPR performed and the patient is cool to touch (not from exposure), no audible heart sounds, and fixed/dilated pupils.

Resuscitation may be **terminated**:

- When the patient regains pulse/respirations
- When the rescuers are physically exhausted or when equally or more highly trained health care personnel take over
- In the absence of ALS, when the same Maine EMS licensed crew member has determined the absence of vital signs for 20 minutes, in spite of BLS, except in the case of hypothermia, see Hypothermia protocol, **Yellow 7**
- When it is found that the patient has a DNR order or other actionable medical order (i.e. POLST/MOLST form, etc.)
- When the following time frames have been met for ALS providers alone:
  - Persistent asystole x 20 minutes
  - Slow and/or wide complex PEA x 20 minutes
  - Fast/narrow PEA x 45 minutes
  - VF/Pulseless VT x 60 minutes
- If ALS providers arrive on scene of a patient managed by BLS providers, consider TOR if:
  - After a total (BLS + ALS) resuscitation time of 20 minutes, the AED has ***never*** advised shock AND the first rhythm noted by ALS providers is asystole or slow/wide PEA
  - If patient is found in fast/narrow PEA does not achieve ROSC after 45 minutes of ALS + BLS care
  - If the patient is found in VF/Pulseless VT does not achieve ROSC after 60 minutes of ALS+BLS care
  - In the case of fast/narrow PEA and VF/Pulseless VT, the ALS provider must complete the ALS algorithm as dictated in these protocols prior to consideration of TOR, regardless of time frame

*Survival and functional neurologic outcomes are unlikely if ROSC is not obtained by EMS. It is dangerous to the crew, pedestrians and other motorists to attempt to resuscitate a patient during ambulance transport. If circumstances do not allow TOR for safety or other reasons, notify OLMC.

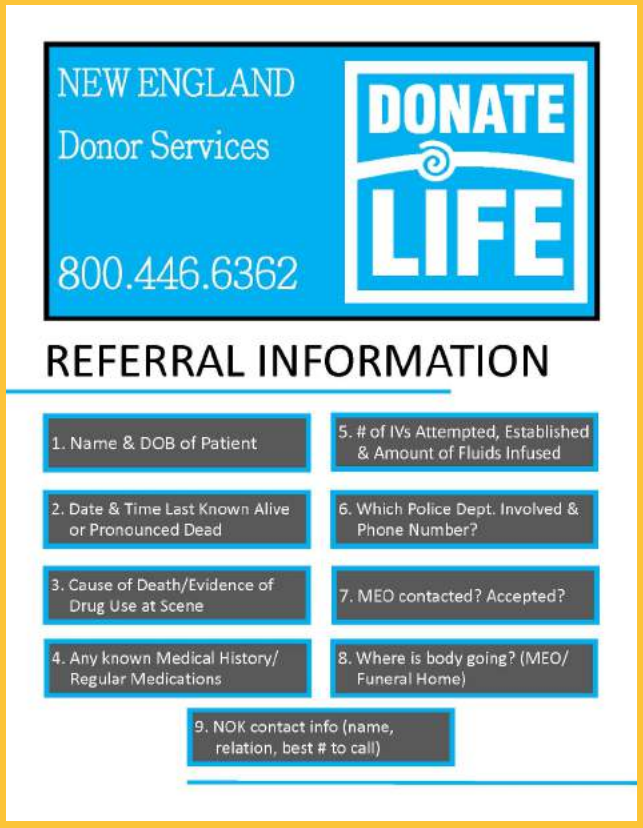
If Resuscitative Efforts are terminated:

1. Focus attention on the family or bystanders. Explain the rationale for termination
2. Consider accessing support for family: other family, friends, or social support such as clergy
3. If termination of resuscitation occurs, one must consider management of the patient's remains. No one option is correct for all circumstances; factors on scene will likely dictate the best option. Refer to **Grey 4**. If questions remain regarding disposition of the patient's remains, contact OLMC. In the event that a patient arrests or re-arrests after leaving the scene and resuscitative efforts are unsuccessful, continue non-emergent transport to the hospital for disposition of the patient remains and family notification. This pathway should also be considered when termination of resuscitation occurs in unsafe or undesirable locations. Please discuss and pre-plan with local hospitals to ensure that all local systems are involved.

Termination of Resuscitation #2

Termination of resuscitation is an important aspect of the medical care of the cardiac arrest patient. When resuscitative efforts have failed to be successful, compassionately transferring attention to the patient's surviving loved ones and ensuring proper final care of the deceased are essential. Please recall from the 2011 Maine EMS Protocol Update that those final steps in care for the deceased include the following:

1) Notification of the family – May have already occurred. However, if the patient passes away without family or friends present, contingencies for family notification must be made.
2) Disposition of Patient Remains – There are multiple options for disposition of patient remains which include local funeral homes, the local ED, the local hospital's morgue, the Medical Examiner's office, etc. It is essential that your service partners with local hospitals, local police, and local funeral homes to facilitate this process. Please refer to the Maine EMS 2011 EMS Protocol FAQ sheet.
3) Notification of the patient's PCP (if the patient has one) and the Medical Examiner
4) Signing the patient's death certificate – Only a physician with a relationship to the patient (PCP or treating physician – includes an emergency physician resuscitating the patient) or the Medical Examiner can sign the death certificate.
5) Notification the New England Donor Services at 1-800-446-6362 with the following information; patient's name, date of birth, location of arrest, your contact phone number, and time of death.



Adult Post-Resuscitation Care

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EMT

1. Manage airway. Administer O_2 only to keep O_2 sats greater than or equal to 94% and less than 99% (avoid hypo/hyperoxia). Maintain ventilation rate between 10-12 breaths per minute
2. Request ALS

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ADVANCED EMT

3. Provide advanced airway management if indicated and initiate capnography. Avoid excessive ventilation. Aim for ventilation rate between 10-12 breaths per minute
4. Obtain IV access and treat hypotension with fluid boluses. Goal systolic BP after ROSC is greater than or equal to 100 mmHg. For post-resuscitation hypotension, administer fluid boluses. Total volume should not exceed 2000 mL
5. Perform 12-lead ECG, if so trained

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Goal #1 - Identify STEMI

6. If evidence of STEMI on 12-lead ECG, refer to STEMI protocol, **Red 2** and follow local STEMI referral patterns

Goal #2 - Aggressive management of hypotension

7. Goal systolic BP after ROSC is greater than or equal to 100 mmHg. For post-resuscitation hypotension, administer IV fluid boluses. Total volume should not exceed 2000 mL

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8. If hypotension persists, contact OLMC for the following OPTION:

   a. NOREPInephrine **IV infusion**:
      - **i.** **Preparation** - mix NOREPInephrine 8 mg in 250 mL NS
      - **ii.** **Dosing** - starting dose of NOREPInephrine is 0.03 mcg/kg/min. Titrate by 0.03 mcg/kg/min every 3-5 minutes. Usual dose is 0.03 - 0.25 mcg/kg/min. Usual MAX dose is 0.6 mcg/kg/min. Absolute MAX dose is 3 mcg/kg/min
   b. Titrate to maintain systolic BP greater than 100 mmHg
   c. NOREPInephrine infusions in adults and pediatrics must be administered via a Maine EMS-approved medication pump

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9. If seizure develops, refer to Seizure protocol, **Gold 8**

10. If patient suffers loss of spontaneous circulation and re-arrests, refer to appropriate guideline

Tachycardia #1

E

NOTE: For all cases, attempt to identify and treat the underlying cause of the patient's tachycardia which may include maximizing oxygenation or (for Advanced EMTs/Paramedics) maximizing hemodynamics. If uncertainty exists between sinus tachycardia and SVT, please contact OLMC.

EMT

1. Airway management per **Blue 3**
2. Request ALS

A

ADVANCED EMT

3. Establish IV/IO
4. Cardiac monitor, perform 12-lead ECG
5. Request Paramedic

P

PARAMEDIC

If hemodynamically UNSTABLE, as manifested by any of the following: hypotension, altered mental status, syncope/pre- syncope, chest pain, dyspnea, acute heart failure, signs of shock:

6. Consider **synchronized** cardioversion
   - **a. ADULT Regular Narrow** complex (SVT): 50J or monophasic equivalent. With subsequent attempts: 100J, then 120-150J, then 200J, then max available dose
   - **b. ADULT Irregular Narrow** complex (a-fib): 120-200J or monophasic equivalent. Subsequent attempts progress to 200J, then max available dose
   - **c. ADULT Regular Wide** complex (VT): 100J or monophasic equivalent. Subsequent attempts progress to 150J, then 200J then max available dose.
   - d. **PEDIATRIC** Synchronized Cardioversion for all rhythms, per Grey 18, initial cardioversion at 0.5 - 1.0 J/kg. All subsequent cardioversions at 2.0 J/kg

   - e. Consider sedation with midazolam 3 mg **IV/IO/IN** or fentanyl 1 mcg/kg **IV/IO/IN** to MAX of 100 mcg for initial dose
   - f. If unable to synchronize, or in the case of patient instability or polymorphic VT, defibrillate x 1 at 200J or monophasic equivalent

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7. Rate control for A-Fib/A-Flutter ONLY, contact OLMC for option of metoprolol 5 mg **IV** over 5 minutes. REMEMBER, *metoprolol must not be used in hypotension (SBP less than 100 mmHg). Discuss wheezing, if present, with OLMC before administration*

   a. May repeat metoprolol 5 mg **IV** over 5 minutes after consultation with OLMC

8. Contact OLMC for further options, including amiodarone drip (for wide complex tachycardia)

Continued

Continued from previous page:

If hemodynamically STABLE:

9. **Narrow complex** tachycardia (due to rhythms other than sinus tachycardia):
    a. Modified valsalva maneuver - Position patient seated upright and have patient blow into a 10cc syringe forcefully, attempting to move the plunger for 15 sec. Then, immediately lay the patient supine and raise legs to 45 degrees. Hold legs for 1 min, then return to seated position. Reassess. May repeat once.

Position patient seated upright and have patient blowinto a 10cc syringe forcefully, attempting to move the plunger for 15 sec. *

Then, immediately lay the patient supine and raise legs to 45 degrees. Hold legs for 1 min, then return to seated position.*

P

b. Adenosine:
    i. Adult: Adenosine 6 mg **IV** rapid bolus at centrally located peripheral IV with rapid saline flush
        1. May repeat adenosine x 2 at 12 mg **IV** rapid bolus at centrally located peripheral IV with rapid saline flush
    ii. **Pediatric < 50 kg:** Adenosine 0.1 mg/kg **IV** rapid bolus at centrally located peripheral IV with rapid saline flush
        1. May repeat adenosine x 1 at 0.2 mg/kg **IV** rapid bolus at centrally located peripheral IV with rapid saline flush

* Photos courtesy of Appelboam A et al. *Postural Modification to the Standard Valsalva Manoeuvre for Emergency Treatment of Supraventricular Tachycardias (REVERT): A Randomised Controlled Trial.* Lancet 2015. [epub ahead of print]PMID: 26314489. Supplimental material accessed on 6-1-2021

Continued

Tachycardia #3

Continued from previous page:

10. **Wide complex** tachycardia

****Only for **REGULAR** rhythm with MONOmorphic QRS (see PEARL)****

a. Adenosine 6 mg **IV** rapid bolus at centrally located peripheral IV with rapid saline flush
   i. May repeat adenosine x 1 at 12 mg **IV** rapid bolus at centrally located peripheral IV with rapid saline flush

b. Consider amiodarone 150 mg **IV/IO** over 10 minutes

P

For POLYmorphic wide complex tachycardia (Torsades de Pointes)

11. Magnesium sulfate 1-2 grams IV over 5 minutes

Treatment of pre-excitation rhythms (such as WPW) include blocking at the level of the AV node, using adenosine or beta-blockers. Patients with *pre-excitation AND A-fib* should **NOT** receive any agents that block the AV node, as this could cause VF. WPW with A-fib may be recognized by a very fast rhythm, a predominance of wide QRS complexes with occasional narrow complexes and an irregular rhythm. When WPW with A-fib is suspected, the patient should **NOT** receive any medications that block the AV node because this will force all impulses through the accessory pathway and can cause VF. *Instead, these patients should be cardioverted when they become unstable.*

Do **NOT** give adenosine to a patient with Polymorphic VT or Torsades.

Do **NOT** give amiodarone to a patient converted from Polymorphic VT unless QT interval is less than 0.500 sec.

If QT interval is greater than 0.500 sec, contact OLMC for options.

Bradycardia #1
Heart rate less than 50 beats/min

Concerning signs or symptoms: hypotension, altered mental status, syncope/pre-syncope, chest pain, dyspnea, acute heart failure, signs of shock, or cyanosis/pallor:

If NO concerning signs or symptoms, then all levels (EMT/Advanced EMT/Paramedic) may do the following:

1. O_2 as appropriate
2. Advanced EMT/Paramedic ONLY – consider fluid bolus

E

If ANY concerning signs or symptoms, then:

EMT

1. O_2 as appropriate
2. Request Paramedic

A

ADVANCED EMT

3. IV en route and fluid bolus as required
4. Cardiac monitor, perform 12-lead ECG, if so trained
5. Request Paramedic

P

PARAMEDIC

6. Adult - Atropine 1 mg **IV/IO***; give in repeat doses every 3 - 5 minutes up to a maximum dose of 3 mg in the adult patient
7. Pediatric:
   a. EPINEPHrine 1mg/10ml - 0.01 mg/kg IV every 3-5 minutes. Max dose 1 mg
   b. Consider Atropine* for increased vagal tone or primary AV Block
      i. Pediatric Atropine* 0.02 mg/kg IV. May repeat x 1. Minimum dose 0.1 mg and maximum single dose 0.5 mg
8. Apply external pacer—Initiate transcutaneous pacing (TCP) for patients who do not respond to atropine; if serious signs or symptoms, do not delay TCP while awaiting IV/IO access or for atropine to take effect. Consider premedicating with midazolam 3 mg **IV/IN/IO** OR fentanyl 1 mcg/kg **IV/IN/IO** to a MAX first dose of 100 mcg. Notify **OLMC** as **soon as possible.** Check capture frequently (every 2 minutes) by checking peripheral pulses, ensuring the pulse matches the paced rate.

* Transplanted, denervated hearts will not respond to atropine. Proceed to pacing, vasopressor infusion, or both*

Bradycardia #2
Heart rate less than 50 beats/min

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Continued from Previous Page:

PARAMEDIC

9. If continued signs or symptoms, consider:
   a. Repeat atropine or
   b. EPINEPHrine **IV infusion**, which may typically be dosed the following way:
      Preparation - Add 1mL (1mg) of EPINEPHrine 1mg/mL to 250 mL bag NS. This results in a 1 mg/250 mL = 4 mcg/mL mix.
      Dose - Start at 0.05 mcg/kg/min. Titrate by 0.05 mcg/kg/min every 5 min. Titrate to desired desired effect which may include resolution of bradycardia, SPB of > 90 mmHg and/or MAP > 65 mmHg.
      Usual dose is 0.05-0.5 mcg/kg/min. Absolute maximum dose is 0.5 mcg/kg/min
   c. EPINEPHrine infusions must be administered via a Maine EMS-approved medication pump

PEARLS for Bradycardia:

Consider causes of bradycardia:
MI, hypoxia, pacemaker failure, hypothermia, sinus bradycardia, sick sinus syndrome, AV blocks, overdose (calcium channel blockers, beta-blockers, digoxin, organophosphates), hyperkalemia (in wide complex).

Application of **TCP** should be considered if deterioration is anticipated because of the following:
   a. Observed sinus pauses
   b. Episodes of 2nd degree Type II, or 3rd degree AV Block

Pre-medication for TCP is preferably via the IV route. If unable to obtain IV, may try IN route in the cooperative patient with goal of ultimately obtaining IV/IO access.

Bradycardia in the Post-Arrest Patient: Post-ROSC bradycardia is a peri-arrest state. For the patient who has achieved ROSC and becomes bradycardic, be very cautious. Typically, these causes do not respond durably to transcutaneous pacing alone. In addition to transcutaneous pacing, consider early initiation of NOREPInephrine and refer to the post arrest protocol. Check mechanical capture every 2 minutes and restart CPR if no pulse is detected.

Cardiogenic Shock

E

EMT

1. O_2 as appropriate
2. Request ALS
3. If available and so trained, perform 12 lead ECG. EMT's are not certified to interpret the 12-lead ECG or change the ALS response based on obtaining a 12-lead ECG. The purpose of the EMT in obtaining the 12-lead ECG is to present it to the Paramedic and/or receiving facility.

A

ADVANCED EMT

3. Cardiac monitor, obtain 12-lead ECG
4. IV en route
5. Request Paramedic

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6. Contact OLMC with following information:
   Vital signs, lung sounds, cardiac rhythm, pedal edema assessment for OPTION OF:
   a. Fluid bolus

PARAMEDIC

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7. Contact OLMC for the following OPTION:
   a. NOREPInephrine **IV infusion**:
      i. Preparation – mix NOREPInephrine 8 mg in 250 mL NS.
      ii. Dosing - Starting dose is NOREPInephrine 0.03 mcg/kg/min. Titrate by 0.03 mcg/kg/min every 3-5 minutes. Usual dose is 0.03-0.25 mcg/kg/min. Usual max dose is 0.6 mcg/kg/min. Absolute max dose is 3 mcg/kg/min
   b. Titrate to maintain systolic BP greater than 100 mmHg

P

PEARLS for Cardiogenic Shock

- Pediatric patients suffering from suspected cardiogenic shock should receive fluid boluses of 10 mL/kg with frequent reassessment for tolerance and need for additional fluids.
- Pediatric patients rarely require vasopressors. If the patient is not responding to or tolerating intravenous fluids, consult OLMC.

Syncope

E

EMT

1. Obtain history (seizure, stroke, fluid loss, palpitations, chest pain, dizzy, trauma) and consider spinal immobilization if appropriate
2. O_2 as appropriate
3. Perform finger stick to measure blood glucose, if so trained. If blood glucose less than 60 mg/dL, refer to Diabetic/ Hypoglycemic Emergencies protocol, **Gold 6**
4. Treat for shock if appropriate. If the cause of the shock is:
   a. Anaphylaxis, refer to Anaphylaxis protocol, **Gold 1**
   b. Cardiogenic, refer to Cardiogenic Shock protocol, **Red 20**
   c. Tension Pneumothorax, see Chest Trauma protocol, **Green 10**
   d. Medical Shock, see Medical Shock protocol, **Gold 14**
5. Request ALS

A P

ADVANCED EMT/PARAMEDIC

6. Establish IV access
7. Cardiac monitor and 12-lead ECG, if so trained
8. Fluid bolus if appropriate
10. AEMT to request Paramedic

NOTE: At any time, if relevant signs/symptoms found, go to appropriate protocol

PEARLS for Syncope

- Syncope is defined as loss of consciousness accompanied by loss of postural tone.
- All of these patients should be transported for emergency evaluation.
- Up to one third of syncope in adults older than 60 is caused by cardiac disorders.
- 12-lead ECGs and cardiac monitoring are important for this patient population. The ECG should be evaluated for potential causes of syncope such as: ischemia, QT prolongation, Brugada Syndrome, pre-excitation, arrhythmia and hypertrophic cardiomyopathy.

A NORMAL ECG DOES NOT RULE OUT CARDIAC CAUSE OF SYNCOPE

* Because of proximity to the event, EMS providers may be the only providers able to capture cardiac causes of syncope.
* Consider other causes including GI bleed, ectopic pregnancy, seizure, stroke, hypoglycemia, shock, toxicologic (i.e. alcohol), pulmonary embolism, and medications.

Ventricular Assist Devices #1

E A P

Patient Care Goals

- Rapid identification of, and interventions for, cardiovascular compromise in patients with VADs
- Rapid identification of, and interventions for, VAD-related malfunctions or complications

Inclusion Criteria

- Any patient with a Ventricular Assist Device

Patient Management

1. For VAD-related complaints, consider early consult with the patient's VAD support team, including the following individuals in the following order:
   a. The patient's VAD coordinator,
   b. The patient's VAD physician,
   c. Other members of the VAD team, or
   d. OLMC at the patient's VAD hospital

2. Assess for possible pump malfunction
   a. Assess for alarms
   b. Auscultate for pump "hum" sound (best heard in the left chest)
   c. Assess for signs of hypoperfusion including pallor, diaphoresis, altered mental status
3. If the VAD pump has malfunctioned:
   a. Utilize available resources to troubleshoot potential VAD malfunctions and to determine appropriate corrective actions to restore normal VAD function
      i. Contact the patient's VAD-trained companion, if available
      ii. Contact the patient's VAD-coordinator, using the phone number on the device
      iii. Check all connections to the system controller
      iv. Change VAD batteries, and/or change the system controller if indicated
      v. Have the patient stop all activity and assess for patient tolerance
      vi. Follow the appropriate protocol for the patient's presenting complaint
4. If the patient is experiencing VAD-related complications or cardiovascular problems, expedite transport to the medical facility where the VAD was placed if the patient's clinical condition and operational considerations allow. If direct transport to the patient's VAD center is not possible, take the patient to the most appropriate facility based on their clinical condition, notifying **OLMC** and the patient's VAD coordinator of destination decision

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a. If patient has a functioning VAD and is experiencing a non-cardiovascular-related problem, contact OLMC and transport to a facility that is appropriate for the patient's main presenting problem without manipulating the device

Ventricular Assist Devices #2

A P

4. If the patient is in cardiac arrest
   a. CPR should NOT be performed if there is any evidence the pump is still functioning. The decision whether to perform CPR should be based upon best clinical judgment. Consult OLMC **or** the patient's VAD coordinator for questions
   b. CPR is indicated only when:
      i. The patient's pump has stopped and troubleshooting efforts to restart the pump have failed, **AND**
      ii. The patient is unresponsive with no detectable signs of life
5. Manage the patient's airway as indicated by **Blue 3**
6. Establish IV/IO access based on the patient's acuity and provider judgment
7. Place the patient on a cardiac monitor
8. Perform 12-lead ECG

PEARLS for VADs

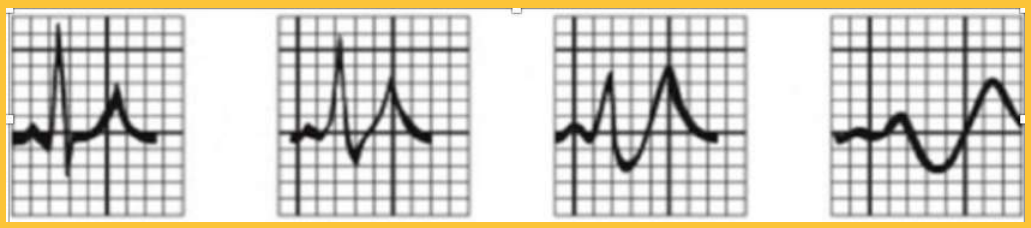
- You do not need to disconnect the controller or batteries in order to defibrillate or cardiovert.
- You do not need to disconnect the controller or batteries in order to acquire a 12-lead ECG.
- Automatic non-invasive cuff blood pressures may be difficult to obtain due to the narrow pulse pressure created by the continuous flow pump.
- Flow through many VAD devices is not pulsatile and patients may not have a palpable pulse or accurate pulse oximetry. The blood pressure, if measurable, may not be an accurate measure of perfusion. Although automatic non-invasive blood pressure cuffs are often ineffective in measuring systolic and diastolic pressure, if they do obtain a measurement, the MAP is usually accurate. Doppler's may be more accurate at determining both pulse and blood pressure and, if available, should be used.
- Patient may be awake with a functioning pump in VF, VT, PEA or asystole. If the patient is responsive AND the encountered rhythm is thought to be new, ACLS therapies, including defibrillation may be attempted, however chest compressions are not necessary if the patient is awake and alert. Evaluate clinical condition and provide care in consultation with VAD coordinator.
- The patient's emergency travel bag should accompany him/her at all times. If feasible, bring the patient's Power Module, cable and Display Module with patient to the hospital.
- The most common cause for VAD alarms are low batteries or battery failures
- Primary pump failure is a very rare occurrence. The most common VAD complications, in descending occurrence, are:
  - Infection
  - Bleeding
  - Arrhythmias
  - CHF
  - Aortic Insufficiency
  - Stroke/TIA
  - Cardiac Tamponade
- Follow the protocol most appropriate, based on the patient's clinical condition.
- For questions, contact OLMC and the patient's VAD Coordinator.
- All patients with a VAD are anticoagulated, typically with warfarin (Coumadin).

Hyperkalemia

Hyperkalemia (elevated serum potassium levels) can become a life-threatening electrolyte disturbance which causes changes in the electrical system of the heart potentially leading to fatal arrhythmias. While serum electrolyte values are not routinely available in the prehospital setting, a paramedic can identify the electrical changes on ECG and initiate prompt treatment.

Patients at highest risk of cardiac consequences of hyperkalemia are those in renal failure: either end stage kidney disease requiring dialysis or with acute decompensations in renal function. The most common at-risk patient is the dialysis dependent patient who has missed one or more scheduled dialysis sessions and thus has accumulated dangerously high levels of electrolytes, including potassium. There are also a number of prescription medications that can alter serum potassium levels such as diuretics, blood pressure medications, chemotherapy agents, and more.

Electrocardiographic signs of hyperkalemia include the following:



Peaked T-Wave (tall and symmetric)	Widened QRS	Widened QRS and lengthened QT interval

P

1. Obtain 12-lead ECG and evaluate for signs of hyperkalemia, including peaked T waves, widened QRS, lengthened QT interval, loss of P waves.
2. Perform continuous cardiac monitoring
3. Establish 2 points of IV/IO access
4. If ECG changes suggestive of hyperkalemia are noted, administer:
   a. IV/IO fluid bolus: 500-1000ml (NS or LR)
   b. Calcium gluconate - **NOTE**: DO NOT administer Calcium through same IV/IO as Sodium Bicarbonate
      i. **Adult**: 2 grams diluted in 50-100 mL NS or D5W **IV/IO** over 5 minutes
      ii. **Pediatric**: 60mg/kg diluted in 50-100 mL NS or D5W (with MAX dose of 2 grams) **IV/IO** over 10 minutes
   c. Sodium bicarbonate - **NOTE**: DO NOT administer Sodium Bicarbonate through same IV/IO as Calcium
      i. **Adult**: 50mEq IV/IO
      ii. **Pediatric**: 1mEq/kg IV/IO over 5 minutes with MAX dose of 50mEq (8.4% sodium bicarbonate must be diluted with D5W to 4.2% [0.5 mEq/mL] prior to administration in patients less than 2 years of age.)
   d. Albuterol
      i. **Adult**: 15 mg via nebulizer
      ii. **Pediatric**:
         1. Pediatric less than 25 kg - 2.5 mg via nebulizer
         2. Pediatric greater than 25 kg - 5 mg via nebulizer
5. Repeat 12-lead ECG after treatment to evaluate for improvement
6. Consult OLMC with questions or to discuss repeat doses if ECG not improved

Continued

Hyperkalemia, continued

P

Paramedic cont.

7. **Note:** If patient progresses to cardiac arrest, give the following early in your resuscitation efforts (**Refer to Red 8 – Cardiac Arrest #1**):
   a. Calcium gluconate,:
      i. **Adult**: 3 gram **IV/IO push,** may repeat in 10 minutes
      ii. **Pediatric**: 60 mg/kg IV/IO **push**, max dose 3000 mg, may repeat in 10 minutes

   b. Sodium bicarbonate,:
      i. **Adult**: 50mEq **IV/IO push**
      ii. **Pediatric**: 1 to 2 mEq/kg bolus MAX single dose: 50 mEq, repeat every 5 minutes until QRS duration less than 120 msec

   c. Fluid bolus

PEARLS for Hyperkalemia:

- Higher serum potassium levels (reported as K+) may not directly correlate with higher risk for cardiac instability, any elevation in serum potassium can increase risk of cardiac instability.
- Hyperkalemia should ONLY be treated if ECG changes are present. Patients presenting with elevated serum potassium levels based on outpatient/hospital lab testing do not warrant treatment unless ECG changes are present. If elevated serum potassium levels are noted on laboratory testing, obtain 12-lead ECG and perform continuous cardiac monitoring to evaluate for electrical changes.
- These can be dynamic situations. Monitor QRS complexes closely after therapy. If initial improvement, but recurrence of QRS changes, please re-initiate protocol.
- The treatment of hyperkalemia is based on several mechanisms:
  - Dilution: dilution of the serum potassium with fluid bolus
  - Cardiac stabilization: calcium gluconate stabilizes the electrical conduction system of the heart, making it less susceptible to electrolyte disturbance
  - Potassium shift: albuterol and sodium bicarbonate can temporarily shift potassium ions from the serum into cells, thus reducing the serum potassium level. The half-life of albuterol is short, but may temporarily improve serum potassium levels while the other treatments take effect.