Adult Asystole / Pulseless Electrical Activity

History
- SAMPLE
- Estimated downtime
- See Reversible Causes below
- DNR, MOST, or Living Will

Signs and Symptoms
- Pulseless
- Apneic
- No electrical activity on ECG
- No heart tones on auscultation

Differential
- See Reversible Causes below

Cardiac Arrest Protocol AC 3

Criteria for Death / No Resuscitation
Review DNR / MOST Form

YES →
Decomposition
Rigor mortis
Dependent lividity
Blunt force trauma
Injury incompatible with life
Extended downtime with asystole

Do not begin resuscitation

Follow Deceased Persons Policy

NO ↓

Begin Continuous CPR Compressions
Push Hard (≥ 2 inches)
Push Fast (100 - 120 / min)
Change Compressors every 2 minutes (sooner if fatigued)
(Limit changes / pulse checks ≤ 10 seconds)

Ventilate 1 breath every 6 seconds
30:2 Compression:Ventilation if no Advanced Airway
Monitor EtCO2 if available

AED Procedure ***if available***

P — Cardiac Monitor

IV or IO Access Protocol UP 6

A — **Epi (1:1K) 5mg IM or Epi (1:10K) 1 mg IV / IO x 1**

A — **Normal Saline Bolus 500 mL IV / IO**
May repeat as needed
Maximum 2 L

Search for Reversible Causes

Blood Glucose Analysis Procedure ***if applicable***

P — **Consider Bicarb 100 mEq IV/IO if history of renal failure or Suspected Overdose**

On Scene Resuscitation / Termination of Resuscitation Protocol(s) AC 12 ***as indicated***

Reversible Causes
Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypothermia
Hypo / Hyperkalemia

Tension pneumothorax
Tamponade; cardiac
Toxins
Thrombosis; pulmonary (PE)
Thrombosis; coronary (MI)

Suspected Opioid Overdose
Administer Naloxone per Overdose / Toxic Ingestion Protocol TE 7

AT ANY TIME

Return of Spontaneous Circulation

Go to Post Resuscitation Protocol AC 10

Notify Destination or Contact Medical Control

Adult Asystole / Pulseless Electrical Activity

Priorities:

- Immediate Initiation of high quality CPR & rhythm interpretation.
- Rapid administration of intramuscular or IV Epinephrine
- Goal is to work the code in place and minimize all movement to maximize highest quality CPR
- Minimum. 10 minute cool down time after obtaining ROSC Unless priority time critical diagnosis suspected as in STEMI, Trauma arrest, severe stroke or intracranial hemorrhage.

Intramuscular epinephrine should be given rapidly and as early as possible in Cardiac arrest.

Only one dose of code epinephrine(IV/IM/IO) will be given per patient encounter. If ROSC is obtained. Epi drip or push dose EPI may be utilized. No additional code dose epinephrine If the patient re-arrests.

Pearls

- **Team Focused Approach / Pit-Crew Approach recommended; assigning responders to predetermined tasks. Refer to optional Team Focused CPR Protocol AC 11 or development of local agency protocol.**
- **Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated.**
- **DO NOT HYPERVENTILATE: If no advanced airway (BIAD, ETT), compression to ventilation ratio is 30:2. If advanced airway in place, ventilate 10 breaths per minute with continuous, uninterrupted compressions.**
- **Do not interrupt compressions to place endotracheal tube. Consider BIAD first to limit interruptions.**
- **Passive oxygenation optional in agencies practicing Team Focused Approach / Pit-Crew Approach.**
- **Reassess and document BIAD and / or endotracheal tube placement and EtCO2 frequently, after every move, and at transfer of care.**
- **IV / IO access and drug delivery are secondary to high-quality chest compressions and early defibrillation**.
- **IV access is preferred route. Follow IV or IO Access Protocol UP 6.**
- **Defibrillation:** Follow manufacture's recommendations concerning defibrillation / cardioversion energy when specified.
- **End Tidal CO2 (EtCO2)**
  If EtCO2 is < 10 mmHg, improve chest compressions. Goal is ≥ 20 mmHg.
  If EtCO2 spikes, typically > 40 mmHg, consider Return of Spontaneous Circulation (ROSC)
- **Special Considerations**
  Maternal Arrest - Treat mother per appropriate protocol with immediate notification to Medical Control and rapid transport preferably to obstetrical center if available and proximate. Place mother supine and perform Manual Left Uterine Displacement moving uterus to the patient's left side. IV/IO access preferably above diaphragm. Defibrillation is safe at all energy levels.
  Renal Dialysis / Renal Failure - Refer to Dialysis / Renal Failure Protocol AM 3 caveats when faced with dialysis / renal failure patient experiencing cardiac arrest.
  Opioid Overdose - If suspected, administer Naloxone per Overdose / Toxic Ingestion Protocol TE 7 while ensuring airway, oxygenation, ventilations, and high-quality chest compressions.
  Drowning / Suffocation / Asphyxiation / Hanging / Lightning Strike – Hypoxic associated cardiac arrest and prompt attention to airway and ventilation is priority followed by high-quality and continuous chest compressions and early defibrillation.
- **Transcutaneous Pacing:**
  Pacing is NOT effective in cardiac arrest and pacing in cardiac arrest does NOT increase chance of survival
- Success is based on proper planning and execution. Procedures require space and patient access. Make room to work.
- Discussion with Medical Control can be a valuable tool in developing a differential diagnosis and identifying possible treatment options.

Bradycardia; Pulse Present

History
- Past medical history
- Medications
  - Beta-Blockers
  - Calcium channel blockers
  - Clonidine
  - Digoxin
- Pacemaker

Signs and Symptoms
- HR < 50/min with hypotension, acute altered mental status, chest pain, acute CHF, seizures, syncope, or shock secondary to bradycardia
- Chest pain
- Respiratory distress
- Hypotension or Shock
- Altered mental status
- Syncope

Differential
- Acute myocardial infarction
- Hypoxia / Hypothermia
- Pacemaker failure
- Sinus bradycardia
- Head injury (elevated ICP) or Stroke
- Spinal cord lesion
- Sick sinus syndrome
- AV blocks (1°, 2°, or 3°)
- Overdose

Heart Rate < 50 / min and Symptomatic:
Hypotension, Acute AMS, Ischemic Chest Pain, Acute CHF, Seizures, Syncope, or Shock secondary to bradycardia
If asymptomatic with stable BP exit protocol

NO → Exit to Appropriate Protocol(s)

YES

Airway Protocol(s) AR 1, 2, 3
if indicated

Respiratory Distress Protocol AR 4
if indicated

Chest Pain: Cardiac and STEMI Protocol AC 4
if indicated

B
- Search for Reversible Causes
- 12 Lead ECG Procedure

IV / IO Protocol UP 6

P Cardiac Monitor

A **Normal Saline / LR Fluid Bolus**
500 mL – 2 L NS IV / IO
(Unless Acute CHF)
Maximum 2 L

P

Atropine 1 mg IV / IO
May repeat every 3 – 5 minutes
Maximum 3 mg

Epinephrine Push Dose 10- 20 mcg/min IV/IO

Norepinephrine Push Dose 4-16 mcg/min IV/IO

Norepinephrine 2 - 20 mcg / minute IV / IO

Epinephrine 1 - 10 mcg/min IV / IO
Titrate to SBP ≥ 90 mmHg

If No Improvement and Unstable
Transcutaneous Pacing Procedure
(Consider earlier in 2nd or 3rd AVB)

P Consider Sedation only when stable

Midazolam 2 – 2.5 mg
IV / IO / IM / IN

Maximum 10 mg

Notify Destination or Contact Medical Control

Reversible Causes

Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypothermia
Hypo / Hyperkalemia

Tension pneumothorax
Tamponade; cardiac
Toxins
Thrombosis; pulmonary (PE)
Thrombosis; coronary (MI)

Suspected Beta-Blocker or Calcium Channel Blocker

Follow Overdose/ Toxic Ingestion Protocol TE 7

Bradycardia; Pulse Present

"Dirty" or "Easy" Epi Drip Mixing Instructions

Inject 1mg of Epi into 1000cc Bag of Normal Saline - Epi can Be 1:1000 or 1:10K (difference is negligible) – . Concentration will be 1 mcg/ml.
The maximum rate of infusion will vary with catheter size, IV bag height, and squeeze on the bag; however, with a wide-open 18-gauge IV, the patient will receive about 20-30 mL/min (or 20-30 mcg/min) of epinephrine, which is similar to the recommended push-dose epi (0.1 mg or 100 mcg over 5 minutes = 20 mcg per minute)

Remember Push Dose Pressors effects are temporary – if more than 2 doses are needed switch to the Norepi or Epi drips

EPINEPHRINE	Infusion	Push-dose syringe
	Preparation: ❑ Add 4 mg epinephrine 1:1,000 to 250 mL bag of Normal Saline Yields Epinephrine concentration of 16 mcg / mL ❑ Label the bag **Administration:** (1 – 10 mcg / min epinephrine) **IV Infusion Pump:** 4 – 38 mL / Hour **60 gtts / mL tubing:** 4 – 40 drips per minute	**Preparation:** ❑ Draw up 9 mL Normal Saline in 10 cc syringe ❑ Add the 1 mL epinephrine 1:10,000 Yields Epinephrine concentration of 10 mcg / mL ❑ Label the syringe **Administration:** **Push-Dose Epinephrine** ❑ Administer 1 mL (10 mcg epinephrine)

Pearls

- **Recommended Exam: Mental Status, HEENT, Skin, Heart, Lungs, Abdomen, Back, Extremities, Neuro**
- **Identifying signs and symptoms of poor perfusion caused by bradycardia are paramount.**
- **Rhythm should be interpreted in the context of symptoms and pharmacological treatment given only when symptomatic, otherwise monitor and reassess.**
- **Consider hyperkalemia with wide complex, bizarre appearance of QRS complex, and bradycardia. Give Calcium Chloride or Gluconate in addition to Sodium Bicarbonate if hyperkalemia suspected.**
- **12-Lead ECG:**
  - **12 Lead ECG not necessary to diagnose and treat**
  - **Obtain when patient is stable and/or following rhythm conversion.**
- **Unstable condition**
  - **Condition which acutely impairs vital organ function and cardiac arrest may be imminent.**
  - **If at any point patient becomes unstable move to unstable arm in algorithm.**
- **Hypoxemia is a common cause of bradycardia. Ensure oxygenation and support respiratory effort.**
- **Atropine:**
  - **Atropine is considered a first line agent in symptomatic bradycardia.**
  - **Ineffective and potentially harmful in cardiac transplantation. May cause paradoxical bradycardia.**
- **Symptomatic bradycardia causing shock or peri-arrest condition:**
  - **If no IV or IO access immediately available start Transcutaneous Pacing, establish IV / IO access, and then administer atropine and/or epinephrine.**
  - **Epinephrine or Dopamine may be considered if no response to Atropine.**
- **Symptomatic condition**
  - **Arrhythmia is causing symptoms such as palpitations, lightheadedness, or dyspnea, but cardiac arrest is not imminent.**
  - **Symptomatic bradycardia usually occurs at rates < 50 beats per minute.**
  - **Search for underlying causes such as hypoxia or impending respiratory failure.**
- **Serious Signs / Symptoms:**
  - **Hypotension. Acutely altered mental status. Signs of shock / poor perfusion. Chest pain with evidence of ischemia (STEMI, T wave inversions or depressions.) Acute CHF.**
- **Transcutaneous Pacing Procedure (TCP)**
  - **Indicated with unstable bradycardia unresponsive to medical therapy.**
  - **If time allows transport to specialty center because transcutaneous pacing is a temporizing measure.**
  - **Transvenous / permanent pacemaker will probably be needed.**
  - **Immediate TCP with high-degree AV block (2d or 3d degree) with no IV / IO access.**
- Consider treatable causes for bradycardia (Beta Blocker OD, Calcium Channel Blocker OD, etc.)

Cardiac Arrest; Adult

AT ANY TIME

Return of Spontaneous Circulation

Go to Post Resuscitation Protocol AC 10

Criteria for Death / No Resuscitation
Review DNR / MOST Form

YES

Decomposition
Rigor mortis
Dependent lividity
Blunt force trauma
Injury incompatible with life
Extended downtime with asystole

Do not begin resuscitation

Follow Deceased Persons Policy

NO

Begin Continuous CPR Compressions
Push Hard (≥ 2 inches)
Push Fast (100 - 120 / min)
Change Compressors every 2 minutes
(sooner if fatigued)
(Limit changes / pulse checks ≤ 10 seconds)

Ventilate 1 breath every 6 seconds
30:2 Compression:Ventilation if no Advanced Airway
Monitor EtCO2
if available

ALS Available

NO → AED Procedure ***if available***

YES → **P** Cardiac Monitor

NO ← Shockable Rhythm → YES

NO → AED Procedure

Continue CPR
2 Minutes

Repeat and reassess

Airway
Protocol(s) AR 1, 2, 3

NO ← Shockable Rhythm → YES

Asystole / PEA
Protocol AC 1
as indicated

Airway
Protocol(s) AR 1, 2, 3

VF / VT
Protocol AC 9
Tachycardia
Protocol(s) AC 6, 7
as indicated

Airway
Protocol(s) AR 1, 2, 3

Arrest secondary to Opioid OD?

YES

Naloxone 0.4 – 2 mg IN / IM
Peds: 0.1 mg/kg IN

Maximum 4 mg

A
Naloxone 0.4 – 2 mg
Peds: 0.1 mg/kg
IV / IO / IM / IN / ETT

Maximum 4 mg

NO

Termination on Scene
Protocol AC 12
as indicated

Notify Destination or Contact Medical Control

Cardiac Arrest; Adult

Pearls

- **Team Focused Approach / Pit-Crew Approach recommended; assign responders to predetermined tasks. Refer to optional protocol or development of local agency protocol.**
- **Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated.**
- **DO NOT HYPERVENTILATE: If no advanced airway (BIAD, ETT) compression to ventilation ratio is 30:2. If advanced airway in place, ventilate 10 breaths per minute with continuous, uninterrupted compressions.**
- **Do not interrupt compressions to place endotracheal tube. Consider BIAD first to limit interruptions.**
- **Passive oxygenation optional in agencies practicing Team Focused Approach / Pit-Crew Approach.**
- **Reassess and document BIAD and / or endotracheal tube placement and EtCO2 frequently, after every move, and at transfer of care.**
- **IV / IO access and drug delivery is secondary to high-quality chest compressions and early defibrillation**.
- **IV access is preferred route. Follow IV or IO Access Protocol UP 6.**
- **Defibrillation:**
  Follow manufacture's recommendations concerning defibrillation / cardioversion energy when specified.
  Charge defibrillator during chest compressions, near the end of 2-minute cycle, to decrease peri-shock pause.
  Following defibrillation, provider should immediately restart chest compressions with no pulse check until end of next cycle.
- **End Tidal CO2 (EtCO2)**
  If EtCO2 is < 10 mmHg, improve chest compressions. Goal is ≥ 20 mmHg.
  If EtCO2 spikes, typically > 40 mmHg, consider Return of Spontaneous Circulation (ROSC)
- **Special Considerations**
  Maternal Arrest - Treat mother per appropriate protocol with immediate notification to Medical Control and rapid transport preferably to obstetrical center if available and proximate. Place mother supine and perform Manual Left Uterine Displacement moving uterus to the patient's left side. IV/IO access preferably above diaphragm. Defibrillation is safe at all energy levels.
  Renal Dialysis / Renal Failure - Refer to Dialysis / Renal Failure Protocol AM 3 caveats when faced with dialysis / renal failure patient experiencing cardiac arrest.
  Opioid Overdose - If suspected, administer Naloxone per Overdose / Toxic Ingestion Protocol TE 7 while ensuring airway, oxygenation, ventilations, and high-quality chest compressions.
  Drowning / Suffocation / Asphyxiation / Hanging / Lightning Strike – Hypoxic associated cardiac arrest and prompt attention to airway and ventilation is priority followed by high-quality and continuous chest compressions and early defibrillation.
- **Transcutaneous Pacing:**
  Pacing is NOT effective in cardiac arrest and pacing in cardiac arrest does NOT increase chance of survival
- Success is based on proper planning and execution. Procedures require space and patient access. Make room to work.
- Discussion with Medical Control can be a valuable tool in developing a differential diagnosis and identifying possible treatment options.

Chest Pain: Cardiac and STEMI

History
- Age
- Medications (Viagra / sildenafil, Levitra / vardenafil, Cialis / tadalafil)
- Past medical history (MI, Angina, Diabetes, post menopausal)
- Allergies
- Recent physical exertion
- **O**nset / **P**alliation / **P**rovocation
- **Q**uality (crampy, constant, sharp, dull, etc.)
- **R**egion / **R**adiation / **R**eferred
- **S**everity (1-10)
- **T**ime (onset /duration / repetition)

Signs & Symptoms
- CP (pain, pressure, aching, vice-like tightness)
- Location (substernal, epigastric, arm, jaw, neck, shoulder)
- Radiation of pain
- Pale, diaphoresis
- Shortness of breath
- Nausea, vomiting, dizziness
- **Time of Onset**
- Women:
  - More likely to have dyspnea,
  - N/V, weakness, back or jaw pain

Differential
- Trauma vs. Medical
- Angina vs. Myocardial infarction
- Pericarditis
- Pulmonary embolism
- Asthma / COPD
- Pneumothorax
- Aortic dissection or aneurysm
- GE reflux or Hiatal hernia
- Esophageal spasm
- Chest wall injury or pain
- Pleural pain
- Overdose: Cocaine or Methamphetamine

B — **12 Lead ECG Procedure – Goal: Door to EKG <5 min**

B — **Aspirin 81 mg x 4 PO (chewed)**
Or **325 mg PO**

B — **Nitroglycerin 0.3 / 0.4 mg Sublingual**
Repeat every 5 minutes x 3
if prescribed to patient and (BP ≥ 100)

P — Cardiac Monitor

Acute MI / STEMI
See box to right

YES →

Transport based on:

STEMI
EMS Triage and Destination Plan

CarolinaEast / Novant / ECU

Pulsara for Notification / EKG Transmission

Keep Scene Time to ≤ 10 Minutes

B — *If transporting to Non PCI Center*
Reperfusion Checklist

P — **Heparin IV Bolus**
50 units/kg IV x 1

Max 5,000 units

Contraindicated in Altered Mental Status / Sepsis / Stroke like symptoms

NO ↓

IV / IO Protocol UP 6

A — **Nitroglycerin 0.3 / 0.4 mg SL**
Repeat every 5 minutes as needed
Keep SBP > 100

P — **Morphine 2 – 4 mg IV / IO**
Repeat every 5 minutes as needed
Maximum 20 mg
Or
Fentanyl 50 – 100 mcg IV / IO
Repeat 25 mcg every 5 minutes as needed
Maximum 300 mcg

Hypotension / Shock Protocol AM 5
if indicated

CHF / Pulmonary Edema Protocol AC 5
if indicated

Acute MI / STEMI

STEMI Definition:

- **≥ 1 mm ST Segment elevation in ≥ 2 contiguous leads**
- **≥ 2 mm ST/J point elevation in V2-V3**
- **Imposters – LBBB, LVH, Paced only using Smith's Modified Sgarbossa's Criteria**
- **Exclusions: Sepsis / Septic Shock, Positive Stroke Screen**

*** Consider placing 2 IV sites in the left arm ***
Many PCI centers use the right radial artery for intervention.
Unless Prior Cabg then will use femoral approach - include this Hx in Pulsara

Notify Destination or Contact Medical Control

Chest Pain: Cardiac and STEMI

May substitute weight based Fentanyl dosing used in UP-11

Pearls

- **Recommended Exam: Mental Status, Skin, Neck, Lung, Heart, Abdomen, Back, Extremities, Neuro**
- **Items in Red Text are the key performance indicators for the EMS Acute Cardiac (STEMI) Care Toolkit**
- **Nitroglycerin:**
  - **Avoid Nitroglycerin in any patient who has used Viagra (sildenafil) or Levitra (vardenafil) in the past 24 hours or Cialis (tadalafil) in the past 36 hours due to potential severe hypotension.**
  - **Nitroglycerin may cause hypotension during any type myocardial infarction. It is NOT more likely to cause hypotension in an inferior MI and should NOT be avoided unless already hypotensive.**
- **STEMI (ST-Elevation Myocardial Infarction)**
  - **Positive Reperfusion Checklist should be transported to the appropriate facility based on STEMI EMS Triage and Destination Plan.**
  - **Consider placing 2 IV sites in the left arm: Many PCI centers use the right radial artery for intervention.**
  - **Consider placing defibrillator pads on patient as a precaution.**
  - **Consider Normal Saline or Lactated Ringers bolus of 250 – 500 mL as pre-cath hydration.**
  - **Scene time goal is < 15 minutes.**
  - **Document and time-stamp facility STEMI notification and make notification as soon as possible.**
  - **Document the time of the 12-Lead ECG in the PCR as a Procedure along with the interpretation (Paramedic).**
- **Cardiac related symptoms in men and women:**
  - Pressure, squeezing, fullness, or pain in the chest.
  - Pain or discomfort in one or both arms, the back, neck, jaw, or stomach.
  - Shortness of breath with or without chest pain.
  - Sweating, nausea, weakness, and/or lightheadedness.
  - **Women, diabetic patients, and the elderly often experience only weakness, shortness of breath, nausea/ vomiting, and back or jaw pain.**

EMT:

- **EMT may administer Nitroglycerin from EMS Supply,** Approved by Dr Koontz and the NC office of EMS.
- If patient has taken nitroglycerin without relief, consider potency of the medication.
- Monitor for hypotension after administration of nitroglycerin and opioids.
- Agency medical director does not require Contact of Medical Control prior to administration.

CHF / Pulmonary Edema

History
- Congestive heart failure
- Past medical history
- Medications (digoxin, Lasix, Viagra / sildenafil, Levitra / vardenafil, Cialis / tadalafil)
- Cardiac history --past myocardial infarction

Signs and Symptoms
- Respiratory distress, bilateral rales
- Apprehension, orthopnea
- Jugular vein distention
- Pink, frothy sputum
- Peripheral edema, diaphoresis
- Hypotension, shock
- Chest pain

Differential
- Myocardial infarction
- Congestive heart failure
- Asthma
- Anaphylaxis
- Aspiration
- COPD
- Pleural effusion
- Pneumonia
- Pulmonary embolus
- Pericardial tamponade
- Toxic Exposure

Airway
Protocol(s) AR 1, 2, 3
as indicated

Chest Pain and STEMI
Protocol AC 4
if indicated

B — 12 Lead ECG Procedure

B — **Nitroglycerin 0.3 / 0.4 mg Sublingual**
Repeat every 5 minutes x 3
if prescribed to patient and (BP >100)

P — Cardiac Monitor

IV / IO Procedure

Assess Symptom Severity

MILD
Normal Heart Rate
Elevated or Normal BP

A — **Nitroglycerin 0.3 / 0.4 mg SL**
Repeat every 5 minutes

Improving — NO → B — **Airway NIPPV Procedure**

YES

MODERATE / SEVERE / SCAPE
Elevated Heart Rate
Elevated BP

B — **Airway NIPPV Procedure**

P — Nitroglycerin 400 mcg IV slow push
for systolic BP 140 – 160
every 5 min as needed – max 3 doses

Nitroglycerin 600 mcg IV slow push
for systolic BP > 160
every 5 min as needed – max 2 doses

Nitro Drip – See Page 2
Start 100mcg/min
Increase by 50mcg/min q 5min

Consider **Furosemide 40 mg IV**
ONLY IF
Transport time > 30 minutes
Known CHF / Daily Lasix / Afebrile

CARDIOGENIC SHOCK
Tachycardia followed by bradycardia
Hypertension followed by hypotension

B — Remove NIPPV
if in place

Adult Hypotension / Shock
Protocol AM 5
if indicated

Notify Destination or Contact Medical Control

CHF / Pulmonary Edema

PUSH DOSE NITRO plus drip – Sympathetic Crashing Acute Pulmonary Edema (SCAPE)

Administer Nitroglycerin 400 mcg IV slow push for systolic BP between 140 – 160
May repeat x2 every 5 minutes as needed (Max 3 doses total)

Administer Nitroglycerin 600 mcg IV slow push for systolic BP greater than 160
May repeat x2 every 5 minutes as needed (Max 2 doses total)

May draw up with caution as not come in contact with Nitro or use pump to admin bolus.

If close proximity to the hospital / short transport time – may hold off on drip unless using IV pump for boluses.

Start Nitro Drip 100 mcg/min – Increase by 50 mcg/min q 5 minutes
Max 800 mcg/min – Hold if SBP <100
If SBP < 90 stop drip – restart if BP recovers after 5 minutes at 100 mcg/min

Pearls

- **Recommended Exam: Mental Status, Skin, Neck, Lung, Heart, Abdomen, Back, Extremities, Neuro**
- **Items in Red Text are key performance measures used to evaluate protocol compliance and care**
- **Diuretics (furosemide) and opioids have NOT been shown to improve the outcomes of EMS patients with pulmonary edema. Even though this historically has been a mainstay of EMS treatment, it is no longer routinely recommended.**
- **Nitroglycerin:**
  - **Avoid Nitroglycerin in any patient who has used Viagra (sildenafil) or Levitra (vardenafil) in the past 24 hours or Cialis (tadalafil) in the past 36 hours due to potential severe hypotension.**
  - **Nitroglycerin may cause hypotension during any type myocardial infarction. It is NOT more likely to cause hypotension in an inferior MI and should NOT be avoided unless already hypotensive.**
- **Document the time of the 12-Lead ECG in the PCR as a Procedure along with the interpretation (Paramedic).**
- **Consider myocardial infarction in all these patients. Diabetics, geriatric and female patients often have atypical pain, or only generalized complaints.**
- **Cardiac related symptoms in men and women:**
  - Pressure, squeezing, fullness, or pain in the chest.
  - Pain or discomfort in one or both arms, the back, neck, jaw, or stomach.
  - Shortness of breath with or without chest pain.
  - Sweating, nausea, weakness, and/or lightheadedness.
  - **Women, diabetic patients, and the elderly often experience only weakness, shortness of breath, nausea/ vomiting, and back or jaw pain.**
- If patient has taken nitroglycerin without relief, consider potency of the medication.
- Contraindications to opioids include severe COPD and respiratory distress. Monitor the patient closely.
- Monitor for hypotension after administration of nitroglycerin and opioids.
- Allow the patient to be in their position of comfort to maximize their breathing effort.
- **EMT may administer Nitroglycerin to patients. May give from EMS supply**.
- Agency medical director may does not require Contact of Medical Control.

Adult Tachycardia
NARROW (≤ 0.11 sec)

History
- Age
- Past medical history (MI, Angina, Diabetes, post menopausal)
- Recent physical exertion
- Palpitations, irregular heart beat
- **T**ime (onset /duration / repetition)

Signs and Symptoms
- Chest pain, heart failure, dyspnea
- AMS
- Shock, poor perfusion, hypotension
- Pale, diaphoresis
- Shortness of breath
- Nausea, vomiting, dizziness

Differential
- Trauma vs. Medical
- Sinus Tachycardia vs. dysrhythmia
- Fever, sepsis, infection
- Pericarditis, pulmonary embolism
- Aortic dissection or aneurysm
- Overdose: Stimulants

Assess tachycardia in context of clinical condition
Identify and treat underlying cause of tachycardia

UNSTABLE / Serious Signs and Symptoms
HR Typically ≥ 150
Hypotension, Acute AMS, Ischemic Chest Pain, Acute CHF, Seizures, Syncope, or Shock secondary to tachycardia

YES →

P

Consider
Only if regular/narrow complex
Adenosine 12 mg IV / IO
Rapid push with flush
May repeat **12 mg IV / IO**

Cardioversion Procedure

Consider Sedation Prior to Cardioversion – only if stable
Midazolam 2 – 2.5 mg IV / IO / IN
May repeat as needed
Maximum 10 mg
Consider Ketamine 1mg/kg IV / IM

Syncronized
Narrow and Regular: 50 – 100J
Narrow and Irregular: 120 – 200J
May repeat and increase dose with subsequent cardioversion attempts
If refractory - consider changing pad placement

NO

STABLE

B 12 Lead ECG Procedure

P Cardiac Monitor

IV or IO Access Protocol UP 6

Regular Rhythm?

YES →

P

Attempt Vagal Maneuvers Procedure

Adenosine 12 mg IV / IO
Rapid push with flush

May repeat x 1 - **12 mg IV / IO**

NO

P

Diltiazem 0.25 mg/kg IV / IO
Over 2 – 3 minutes
Maximum 25 mg

If No Improvement in 10 minutes
Diltiazem 0.35 mg/kg IV / IO
Maximum 25 mg

If No Improvement in 15 minutes
Lopressor 5mg IV / IO – If SBP >100

Monitor and Reassess

Notify Destination or Contact Medical Control

Adult Tachycardia
NARROW (≤ 0.11 sec)

Lopressor / Metoprolol is optional & can be used as an alternative if Diltiazem is on back order due to drug shortage

Pearls

- **Recommended Exam: Mental Status, Skin, Neck, Lung, Heart, Abdomen, Back, Extremities, Neuro**
- **Most important goal is to differentiate the type of tachycardia and if STABLE or UNSTABLE and SYMPTOMATIC.**
- **12-Lead ECG:**
  - **12 Lead ECG not necessary to diagnose and treat**
  - **Obtain when patient is stable and/or following rhythm conversion.**
- **Unstable condition**
  - **Condition which acutely impairs vital organ function and cardiac arrest may be imminent.**
  - **If at any point patient becomes unstable move to unstable arm in algorithm.**
- **Search for underlying cause of tachycardia such as fever, sepsis, dyspnea, etc.**
- **Typical sinus tachycardia is in the range of 100 to (200 - patient's age) beats per minute.**
- **Symptomatic condition**
  - **Arrhythmia is causing symptoms such as palpitations, lightheadedness, or dyspnea, but cardiac arrest is not imminent.**
  - **Symptomatic tachycardia usually occurs at rates ≥ 150 beats per minute.**
    - **Patients symptomatic with heart rates < 150 likely have impaired cardiac function such as CHF.**
- **Serious Signs / Symptoms:**
  - **Hypotension. Acutely altered mental status. Signs of shock / poor perfusion. Chest pain with evidence of ischemia (STEMI, T wave inversions or depressions.) Acute CHF.**
- **If patient has history or 12 Lead ECG reveals Wolfe Parkinson White (WPW):**
  - **DO NOT administer a Calcium Channel Blocker (e.g. Diltiazem) or Beta Blockers.**
  - **Use caution with Adenosine and give only with defibrillator available.**
- **Regular Narrow-Complex Tachycardia:**
  - Vagal maneuvers and adenosine are preferred. Vagal maneuvers may convert 19% to 54 % of SVT.
  - Using passive leg raise with Valsalva is more effective.
  - Adenosine should be pushed rapidly via proximal IV site followed by 20 mL Normal Saline rapid flush.
  - Adenosine should not be used in the post-cardiac transplant patient without **Contact of Medical Control.**
  - Agencies using both calcium channel blockers and beta blockers should choose one primarily. Giving the agents sequentially requires extreme caution. This may lead to profound bradycardia / hypotension.
- **Irregular Narrow-Complex Tachycardia:**
  - Rate control is more important in pre-hospital setting rather than focus on rhythm conversion.
- **Synchronized Cardioversion:**
  - Recommended to treat UNSTABLE Atrial Fibrillation, Atrial Flutter and SVT.
- Monitor for hypotension after administration of Calcium Channel Blockers or Beta Blockers.
- Document all rhythm changes with monitor strips and obtain monitor strips with each therapeutic intervention.

Adult Monomorphic Tachycardia

Wide Complex (≥0.12 sec)

History
- Age
- Past medical history (MI, Angina, Diabetes, post menopausal)
- Recent physical exertion
- Palpitations, irregular heart beat
- **T**ime (onset /duration / repetition)

Signs and Symptoms
- Chest pain, heart failure, dyspnea
- AMS
- Shock, poor perfusion, hypotension
- Pale, diaphoresis
- Shortness of breath
- Nausea, vomiting, dizziness

Differential
- Trauma vs. Medical
- Sinus Tachycardia vs. dysrrhythmia
- Fever, sepsis, infection
- Pericarditis, pulmonary embolism
- Aortic dissection or aneurysm
- Overdose: Stimulants

Assess tachycardia in context of clinical condition
Identify and treat underlying cause of tachycardia

Unstable/ Serious Signs and Symptoms
HR Typically > 150
Hypotension, Acute AMS, Ischemic Chest Pain, Acute CHF, Seizures, Syncope, or Shock secondary to tachycardia

YES →

P	Cardiac Monitor
	Cardioversion Procedure
	Consider Sedation Prior to Cardioversion **Midazolam 2 - 5 mg IV / IO / IN** May repeat as needed **Maximum 10 mg**
	Wide: Regular and Irregular: 200 – 360J • **Monomorphic QRS (Synchronized)** • **Polymorphic QRS (Not-Synchronized)** *May repeat and increase dose with subsequent cardioversion attempts* *If refractory – change pad placement*

NO ↓

B	12 Lead ECG Procedure
P	Cardiac Monitor
	IV or IO Access Protocol UP 6
P	**Consider consultation with medical control**

Regular Rhythm?

YES →

P	Attempt Vagal Maneuvers Procedure ***Only if regular monomorphic complex***
	Consider **Only if regular monomorphic complex** **Adenosine 12 mg IV / IO** Rapid push with flush May repeat **12 mg IV / IO**

NO ↓

P	**Amiodarone 150 mg in 100 mL of D5W/NSS IV / IO Infuse over 10 minutes** OR **Lidocaine 1.5 mg/kg IV** **May Repeat x1 – Max Dose 3mg/kg**
	Monitor and Reassess
	Notify Destination or Contact Medical Control

Monomorphic QRS:
- **All QRS complexes in a single lead are similar in shape.**

Adult Cardiac Protocol Section

Adult Monomorphic Tachycardia

Wide Complex (≥0.12 sec)

Pearls

- **Recommended Exam: Mental Status, Skin, Neck, Lung, Heart, Abdomen, Extremities, Neuro**
- **Most important goal is to differentiate the type of tachycardia and if STABLE or UNSTABLE and if SYMPTOMATIC.**
- **12-Lead ECG:**
  12-Lead ECG is not necessary to diagnose and treat arrhythmia. A single lead ECG is often all that is needed. Obtain12-Lead when patient is stable and/ or following a rhythm conversion.
- **Monomorphic QRS:**
  All QRS complexes in a single lead are similar in shape.
- **Polymorphic QRS:**
  QRS complexes in a single lead will change shape from complex to complex.
- **Rhythm should be interpreted in the context of symptoms and pharmacological or electrical treatment given only when symptomatic, otherwise monitor and reassess.**
- **Unstable condition**
  Condition which acutely impairs vital organ function and cardiac arrest may be impending.
  If at any point patient becomes unstable move to unstable arm in algorithm.
- **Symptomatic condition**
  Arrhythmia is causing symptoms such as palpitations, lightheadedness, or dyspnea but cardiac arrest is not impending.
  Symptomatic tachycardia usually occurs at rates ≥ 150 beats per minute. Patients symptomatic with heart rates < 150 likely have impaired cardiac function such as CHF.
- **Serious Signs/ Symptoms:**
  Hypotension. Acutely altered mental status. Signs of shock/ poor perfusion. Chest pain with evidence of ischemia (STEMI, T wave inversions or depressions.) Acute congestive heart failure.
- **Search for underlying cause of tachycardia such as fever, sepsis, dyspnea, etc.**
- **Typical sinus tachycardia is in the range of 100 to (220 – patients age) beats per minute.**
- **If patient has history or 12-Lead ECG reveals Wolfe Parkinson White (WPW), DO NOT administer a Calcium Channel Blocker (e.g., Diltiazem) or Beta Blockers. Use caution with Adenosine and give only with defibrillator available.**
- **Regular Wide-Complex Tachycardia:**
  Unstable condition:
  Immediate defibrillation if pulseless and begin CPR.
  Stable condition:
  Typically VT or SVT with aberrancy. Adenosine may be given if regular and monomorphic and if defibrillator available.
  Verapamil contraindicated in wide-complex tachycardias.
  Agencies using Amiodarone, Procainamide, and Lidocaine need to choose one agent primarily. Giving multiple anti-arrhythmics requires contact of Medical Control.
  Atrial arrhythmias with WPW should be treated with Amiodarone or Procainamide
- **Irregular Tachycardia:**
  Wide-complex, irregular tachycardia: Do not administer calcium channel, beta blockers, or adenosine as this may cause paradoxical increase in ventricular rate. This will usually require cardioversion. Contact Medical Control.
- Document all rhythm changes with monitor strips and obtain monitor strips with each therapeutic intervention.

Adult Polymorphic Tachycardia
WIDE (≥ 0.12 sec) Torsades de pointes

History
- Age
- Past medical history (MI, Angina, Diabetes, post menopausal)
- Recent physical exertion
- Palpitations, irregular heart beat
- Time (onset /duration / repetition)

Signs and Symptoms
- Chest pain, heart failure, dyspnea
- AMS
- Shock, poor perfusion, hypotension
- Pale, diaphoresis
- Shortness of breath
- Nausea, vomiting, dizziness

Differential
- Cardiac arrest
- Sinus Tachycardia vs. dysrhythmia
- Fever, sepsis, infection
- Pericarditis, pulmonary embolism
- Aortic dissection or aneurysm
- Overdose

Assess tachycardia in context of clinical condition
Identify and treat underlying cause of tachycardia

Unstable / Serious Signs and Symptoms
HR Typically ≥ 150
Hypotension, Acute AMS, Ischemic Chest Pain, Acute CHF, Seizures, Syncope, or Shock secondary to tachycardia

YES →

P — Defibrillation Procedure

Consider Sedation Prior to Defibrillation
Midazolam 2 – 5 mg IV / IO / IN
May repeat as needed
Maximum 10 mg
Consider Ketamine 1mg/kg IV / IM

Wide and Irregular: 200 – 360J

Polymorphic QRS (Not-Synchronized)

May repeat and increase dose with subsequent cardioversion attempts

NO

B — 12 Lead ECG Procedure
P — Cardiac Monitor
IV or IO Access Protocol UP 6

Pulse Present?

YES → P — **PROCEED**

NO → Exit to Cardiac Arrest Protocol AC 3

QT Interval < 500 msec

P
Amiodarone 150 mg in 100 mL of D5W IV / IO
Infuse over 10 minutes
May repeat if tachycardia recurs or persists

Or

Lidocaine
1 – 1.5 mg/kg IV / IO

May repeat if refractory
Lidocaine
1.5 mg/kg IV / IO

Maximum 3 mg/kg

Monitor and Reassess

QT Interval > 500 msec

P
Consider
Magnesium 2 g IV / IO

May repeat

Maximum 4 g

Monitor and Reassess

Notify Destination or Contact Medical Control

Polymorphic QRS:
- **QRS complexes in a single lead will change shape from complex to complex.**

Adult Polymorphic Tachycardia
WIDE (≥ 0.12 sec) Torsades de pointes

Do not use amiodarone for individuals with polymorphic VT associated with a prolonged QT interval because this may worsen the patient's condition. Administer Magnesium, loading dose 2 Gm IV/IO for polymorphic VT.

Pearls

- **Recommended Exam: Mental Status, Skin, Neck, Lung, Heart, Abdomen, Back, Extremities, Neuro**
- **Most important goal is to differentiate the type of tachycardia and if STABLE or UNSTABLE and SYMPTOMATIC.**
- **12-Lead ECG:**
  - **12 Lead ECG not necessary to diagnose and treat**
  - **Obtain when patient is stable and/or following rhythm conversion.**
- **Monomorphic QRS:**
  - **All QRS complexes in a single lead are similar in shape.**
- **Polymorphic QRS:**
  - **QRS complexes in a single lead will change shape from complex to complex.**
- **Rhythm should be interpreted in the context of symptoms and pharmacological or electrical treatment given only when symptomatic, otherwise monitor and reassess.**
- **Unstable condition**
  - **Condition which acutely impairs vital organ function and cardiac arrest may be imminent.**
  - **If at any point patient becomes unstable move to unstable arm in algorithm.**
- **Symptomatic condition**
  - **Arrhythmia is causing symptoms such as palpitations, lightheadedness, or dyspnea, but cardiac arrest is not imminent.**
  - **Symptomatic tachycardia usually occurs at rates ≥ 150 beats per minute. Patients symptomatic with heart rates < 150 likely have impaired cardiac function such as CHF.**
- **Serious Signs / Symptoms:**
  - **Hypotension. Acutely altered mental status. Signs of shock / poor perfusion. Chest pain with evidence of ischemia (STEMI, T wave inversions or depressions.) Acute congestive heart failure.**
- **Search for underlying cause of tachycardia such as fever, sepsis, dyspnea, etc.**
- **Typical sinus tachycardia is in the range of 100 to (220 – patients age) beats per minute.**
- **If patient has history or 12 Lead ECG reveals Wolfe Parkinson White (WPW), DO NOT administer a Calcium Channel Blocker (e.g., Diltiazem) or Beta Blockers. Use caution with Adenosine and give only with defibrillator available.**
- **Polymorphic / Irregular Tachycardia:**
  - This situation is usually unstable and immediate defibrillation is warranted.
  - If QT length is known, use for decision-making. Prolonged QT length defined as > 500 msec.
  - QT length < 500 msec:
    - Arrhythmia more likely related to ischemia or infarction and Magnesium not likely helpful.
    - May quickly deteriorate into Ventricular Fibrillation.
    - Even when terminated by defibrillation, may recur, so follow with medication therapy.
  - QT prolongation > 500 msec:
    - Magnesium more likely to be helpful.
- Document all rhythm changes with monitor strips and obtain monitor strips with each therapeutic intervention.

Ventricular Fibrillation
Pulseless Ventricular Tachycardia

Cardiac Arrest Protocol AC 3

Begin Continuous CPR Compressions
Push Hard (≥ 2 inches) Push Fast (100 - 120 / min)
Change Compressors every 2 minutes
(*sooner if fatigued*)
(*Limit changes / pulse checks ≤ 10 seconds*)

Ventilate 1 breath every 6 seconds
30:2 Compression:Ventilation if no Advanced Airway
Monitor EtCO2
if available

AED Procedure
if available

A Defibrillation Procedure

IV / IO Access Protocol UP 6

A EPI HAS BEEN DELETED FROM THIS PROTOCOL

Search for Reversible Causes

Continue CPR Compressions
Push Hard (≥ 2 inches) Push Fast (100 - 120 / min)
Change Compressors every 2 minutes
(*sooner if fatigued*)
(*Limit changes / pulse checks ≤ 10 seconds*)

<u>If Rhythm Refractory</u>
Continue CPR and give Agency specific Anti-arrhythmics and Epinephrine
Continue CPR up to point where you are ready to defibrillate with device charged.
Repeat pattern during resuscitation.

P

Amiodarone 300 mg IV / IO

May repeat if refractory
Amiodarone 150 mg IV / IO

Or
Lidocaine 1.5 mg/kg IV / IO

May repeat if refractory
Lidocaine 1.5 mg/kg IV / IO

Maximum 3 mg/kg

A

Refractory VF or VT without pulse
Magnesium 2 gm IV / IO

Defibrillation Procedure
If VF / VT refractory after first shock consider changing vector of defib pads or Double Sequential Defib

P Esmolol 0.5mg/kg IV Bolus x1
Consider For Refractory VT/VF after 2nd shock

Notify Destination or Contact Medical Control

AT ANY TIME

Return of Spontaneous Circulation

Go to Post Resuscitation Protocol AC 10

<u>Reversible Causes</u>

Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypothermia
Hypo / Hyperkalemia

Tension pneumothorax
Tamponade; cardiac
Toxins
Thrombosis; pulmonary (PE)
Thrombosis; coronary (MI)

Ventricular Fibrillation
Pulseless Ventricular Tachycardia

No Code Dose EPI for Shockable Rhythms

May Use Epi if rhythm change to Asystole or PEA.

May use Push Epi or Epi Drip for ROSC.

DSED is recommended after no response after 2nd shock

Services may Opt out of DSED if this violates their monitor service contract and warranty

Consider Esmolol 0.5 mg/kg single bolus after 2nd shock

Pearls

- **Team Focused Approach / Pit-Crew Approach recommended; assigning responders to predetermined tasks. Refer to optional Team Focused CPR Protocol AC 11 or development of local agency protocol.**
- **Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated.**
- **DO NOT HYPERVENTILATE: If no advanced airway (BIAD, ETT) compression to ventilation ratio is 30:2. If advanced airway in place, ventilate 10 breaths per minute with continuous, uninterrupted compressions.**
- **Do not interrupt compressions to place endotracheal tube. Consider BIAD first to limit interruptions.**
- **Passive oxygenation optional in agencies practicing Team Focused Approach / Pit-Crew Approach.**
- **Reassess and document BIAD and / or endotracheal tube placement and EtCO2 frequently, after every move, and at transfer of care.**
- **IV / IO access and drug delivery is secondary to high-quality chest compressions and early defibrillation**.
- **IV access is preferred route. Follow IV or IO Access Protocol UP 6.**
- **Defibrillation:**
  Follow manufacture's recommendations concerning defibrillation / cardioversion energy when specified.
  Charge defibrillator during chest compressions, near the end of 2-minute cycle, to decrease peri-shock pause.
  Following defibrillation, provider should immediately restart chest compressions with no pulse check until end of next cycle.
- **End Tidal CO2 (EtCO2)**
  If EtCO2 is < 10 mmHg, improve chest compressions. Goal is ≥ 20 mmHg.
  If EtCO2 spikes, typically > 40 mmHg, consider Return of Spontaneous Circulation (ROSC
- **Special Considerations**
  Maternal Arrest - Treat mother per appropriate protocol with immediate notification to Medical Control and rapid transport preferably to obstetrical center if available and proximate. Place mother supine and perform Manual Left Uterine Displacement moving uterus to the patient's left side. IV/IO access preferably above diaphragm. Defibrillation is safe at all energy levels.
  Renal Dialysis / Renal Failure - Refer to Dialysis / Renal Failure Protocol AM 3 caveats when faced with dialysis / renal failure patient experiencing cardiac arrest.
  Opioid Overdose - If suspected, administer Naloxone per Overdose / Toxic Ingestion Protocol TE 7 while ensuring airway, oxygenation, ventilations, and high-quality chest compressions.
  Drowning / Suffocation / Asphyxiation / Hanging / Lightning Strike – Hypoxic associated cardiac arrest and prompt attention to airway and ventilation is priority followed by high-quality and continuous chest compressions and early defibrillation.
- **Magnesium Sulfate is not routinely recommended during cardiac arrest, but may help with Torsades de points, prolonged QT, low Magnesium States (malnourished / alcoholic), and suspected digitalis toxicity**
- Return of spontaneous circulation: Heart rate should be > 60 when initiating anti-arrhythmic infusions.
- Success is based on proper planning and execution. Procedures require space and patient access. Make room to work.

Post Resuscitation

Return of Spontaneous Circulation

↓

Repeat Primary Assessment

Do Not Move Pt for 10 minutes unless STEMI

Optimize Ventilation and Oxygenation

- Remove Impedance Threshold Device
- Respiratory Rate 10 / minute
- Maintain SpO2 92 – 98%
- DO NOT HYPERVENTILATE
- Prepare Vasopressors

B	• ETCO2 ideally 35 – 45 mm Hg
	Airway Protocol(s) AR 1, 2, 3, 4 ***as indicated***
B	12 Lead ECG Procedure
	IV or IO Access Protocol UP 6
P	Cardiac Monitor
	Monitor Vital Signs / Reassess
	Search for reversible causes

↓

	Chest Pain and STEMI Protocol AC 4 ***if indicated***
	Hypotension / Shock Protocol AM 5 ***as indicated***
A P	**Optimize Systolic BP and Mean Arterial BP** • Systolic BP > 90 mmHg • Mean Arterial BP > 65 mmHg
	Appropriate Arrhythmia Protocol(s) AC 2, 6, 7 ***as indicated***
	Seizure Protocol UP 13 ***as indicated***
	Post Intubation BIAD Management Protocol AR 8
	Targeted Temperature Management Protocol AC 13 ***if available***

↓

Notify Destination or Contact Medical Control

Transport Destination Decision

Post-resuscitation patient is medically complex.

Consider facility capabilities:

- 24-hour cardiac catheterization laboratory
- Medical ICU service
- Cardiology service
- Neurology service
- Pulmonologyservice
- Targeted Temperature Management

Reversible Causes

Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypothermia
Hypo / Hyperkalemia

Tension pneumothorax
Tamponade; cardiac
Toxins
Thrombosis; pulmonary (PE)
Thrombosis; coronary (MI)

Arrhythmias are common and usually self limiting after ROSC

If Arrhythmia Persists follow Rhythm Appropriate Protocol

Post Resuscitation

ROSC - 10 Minute Cool Down Rules

*** Do not move Pt for 10 minutes POST ROSC Unless CLEAR STEMI **

1. Full Assessment / Vitals / 12 Lead EKG2
2. Secure Airway - No RSI/DAI unless absolutely needed – Highly likelihood of rearrest
3. Correct Hypotension
4. Correct Hypoxia – Do Not Hyperventilate

Pearls

- **Recommended Exam: Mental Status, Neck, Skin, Lungs, Heart, Abdomen, Extremities, Neuro**
- **Continue to search for potential cause of cardiac arrest during post-resuscitation care.**
- **Hyperventilation is a significant cause of hypotension and recurrence of cardiac arrest in the post resuscitation phase and must be avoided. Titrate FiO_2 to maintain SpO_2 of 92 - 98%.**
- **Pain/sedation:**
  - **Patients requiring advanced airways and ventilation commonly experience pain and anxiety.**
  - **Unrelieved pain can lead to increased catecholamine release, ischemia, immunosuppression, and prolonged hospitalization.**
  - **Ventilated patients cannot communicate pain / anxiety and providers are poor at recognizing pain / anxiety.**
  - **Vital signs such has tachycardia and / or hypertension can provide clues to inadequate sedation, however they both are not always reliable indicators of patient's lack of adequate sedation.**
  - **Pain must be addressed first, before anxiety. Opioids are typically the first line agents before benzodiazepines. Ketamine is also a reasonable first choice agent.**
- **Ventilator / Ventilation strategies:**
  - **Tailored to individual patient presentations. Medical Control can indicate different strategies above.**
  - **In general ventilation with BVM should cause chest rise. With mechanical ventilation a reasonable tidal volume should be about 6 mL/kg and peak pressures should be < 30 cmH20.**
  - **Continuous pulse oximetry and capnography should be maintained during transport for monitoring.**
  - **Head of bed should be maintained at least 10 – 20 degrees of elevation when possible to decrease aspiration risk.**
- **EtCO2 Monitoring:**
  - **Initial End tidal CO2 may be elevated immediately post-resuscitation, but will usually normalize.**
  - **Goal is 35 – 45 mmHg but avoid hyperventilation to achieve.**
- **Titrate fluid resuscitation and vasopressor administration to maintain SBP of 90 – 100 mmHg or Mean Arterial Pressure (MAP) of 65 – 80 mmHg.**
- **STEMI (ST-Elevation Myocardial Infarction)**
  - **Consider placing 2 IV sites in the left arm: Many PCI centers use the right radial artery for intervention.**
  - **Consider placing defibrillator pads on patient as a precaution.**
  - **Document and time-stamp facility STEMI notification and make notification as soon as possible.**
  - **Document the time of the 12-Lead ECG in the PCR as a Procedure along with the interpretation (Paramedic).**
- **Consider transport to facility capable of managing the post-arrest patient including hypothermia therapy, cardiology / cardiac catheterization, intensive care service, and neurology services.**
- Targeted Temperature Management (optional):
  - Maintain core temperature between 32 - 36°C.
  - Infusion of cold saline is NOT recommended in the prehospital setting.
  - No evidence suggests improved survival with prehospital cooling.
- The condition of post-resuscitation patients fluctuates rapidly and continuously, and they require close monitoring. Appropriate post-resuscitation management may best be planned in consultation with Medical Control.

Team Focused CPR

Criteria for Death / No Resuscitation
Review DNR / MOST Form

YES

Decomposition
Rigor mortis
Dependent lividity
Blunt force trauma
Injury incompatible with life
Extended downtime with asystole

Do not begin resuscitation

Follow Deceased Persons Policy

NO

Begin Continuous CPR Compressions
Push Hard (≥ 2 inches)
Push Fast (100 - 120 / min)
Change Compressors every 2 minutes (sooner if fatigued)
(Limit changes / pulse checks ≤ 10 seconds)

Ventilate 1 breath every 6 seconds
30:2 Compression:Ventilation if no Advanced Airway
Monitor EtCO2 if available

AT ANY TIME

Return of Spontaneous Circulation

Go to Post Resuscitation Protocol AC 10

First Arriving BLS / ALS Responder – Position #1
Initiate Compressions Only CPR
Initiate Defibrillation Automated Procedure
if available
Call for additional resources

Second Arriving BLS / ALS Responder– Position #2
Assume Compressions or
Initiate Defibrillation Automated / Manual Procedure
Place BIAD
DO NOT Interrupt Compressions
Ventilate at 6 to 8 breaths per minute

Third Arriving Responder – Position #3
BLS or ALS

BLS

Establish Team Leader
(Hierarchy)
Fire Department or Squad Officer
EMT
First Arriving Responder

Rotate with Compressor
To prevent Fatigue and effect high quality compressions
Take direction from Team Leader

Fourth / Subsequent Arriving Responders #4
Take direction from Team Leader

Continue Cardiac Arrest Protocol AC 3

ALS

A

Establish Team Leader – Position A1
(Hierarchy)
EMS ALS Personnel
Fire Department or Squad Officer
EMT
First Arriving Responder

Initiate Defibrillation Automated Procedure
Establish IV / IO Protocol UP 6
Administer Appropriate Medications
Establish Airway with BIAD if not in place

P

Initiate Defibrillation Manual Procedure
Continuous Cardiac Monitoring
Establish IV / IO Protocol UP 6
Administer Appropriate Medications
Establish Airway with BIAD if not in place

Continue Cardiac Arrest Protocol AC 3

Team Leader
ALS Personnel
Responsible for patient care
Responsible for briefing / counseling family

Incident Commander
Fire Department / First Responder Officer
Team Leader until ALS arrival
Manages Scene / Bystanders
Ensures high-quality compressions
Ensures frequent compressor change
Responsible for briefing family prior to ALS arrival

Team Focused CPR

Position 1
- ❑ Place AED/ Monitor
- ❑ Follow prompts or quickly analyze rhythm. Shock if indicated.
- ❑ Initiate Continuous Compressions

Position 2
- ❑ Alternate compressions
- ❑ Place patient on high flow O2

Position 3
- ❑ BVM, OPA/NPA(s)

Position 4
- ❑ Ensure high-quality CPR

Monitor mechanical CPR device position/placement if applicable
- ❑ Time keeper/recorder

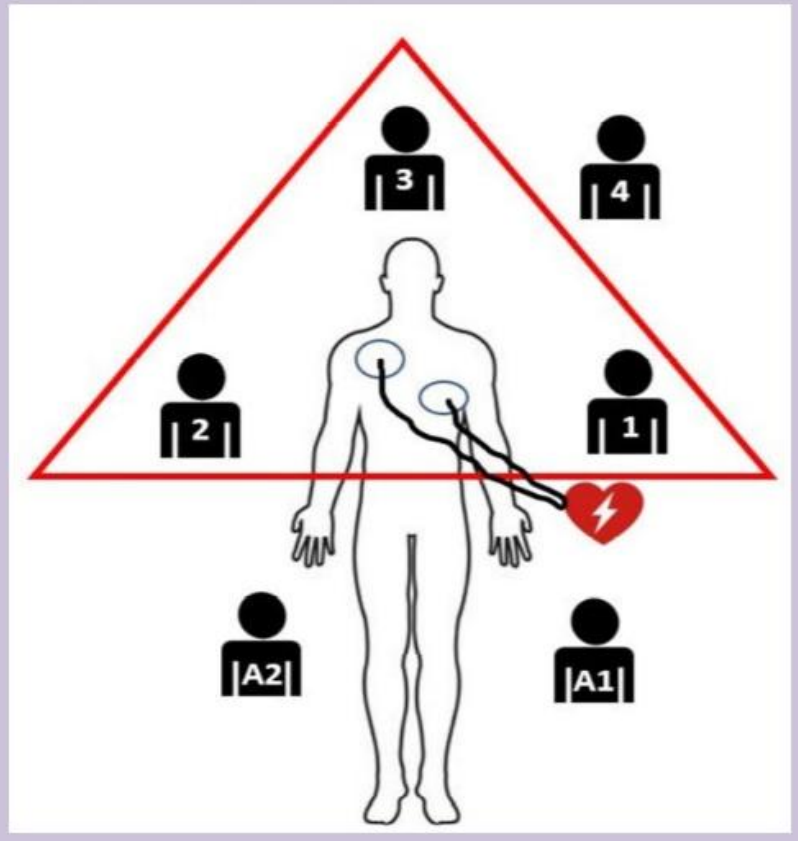
Position A1
- ❑ Cardiac Monitor
- ❑ Prepare for double-sequential defibrillation if applicable
- ❑ Continuous pulse check on femoral
- ❑ May also fill Position 4 role if needed

Position A2
- ❑ Obtain IV / IO Access
- ❑ Administer medications

Fill positions in numerical order.

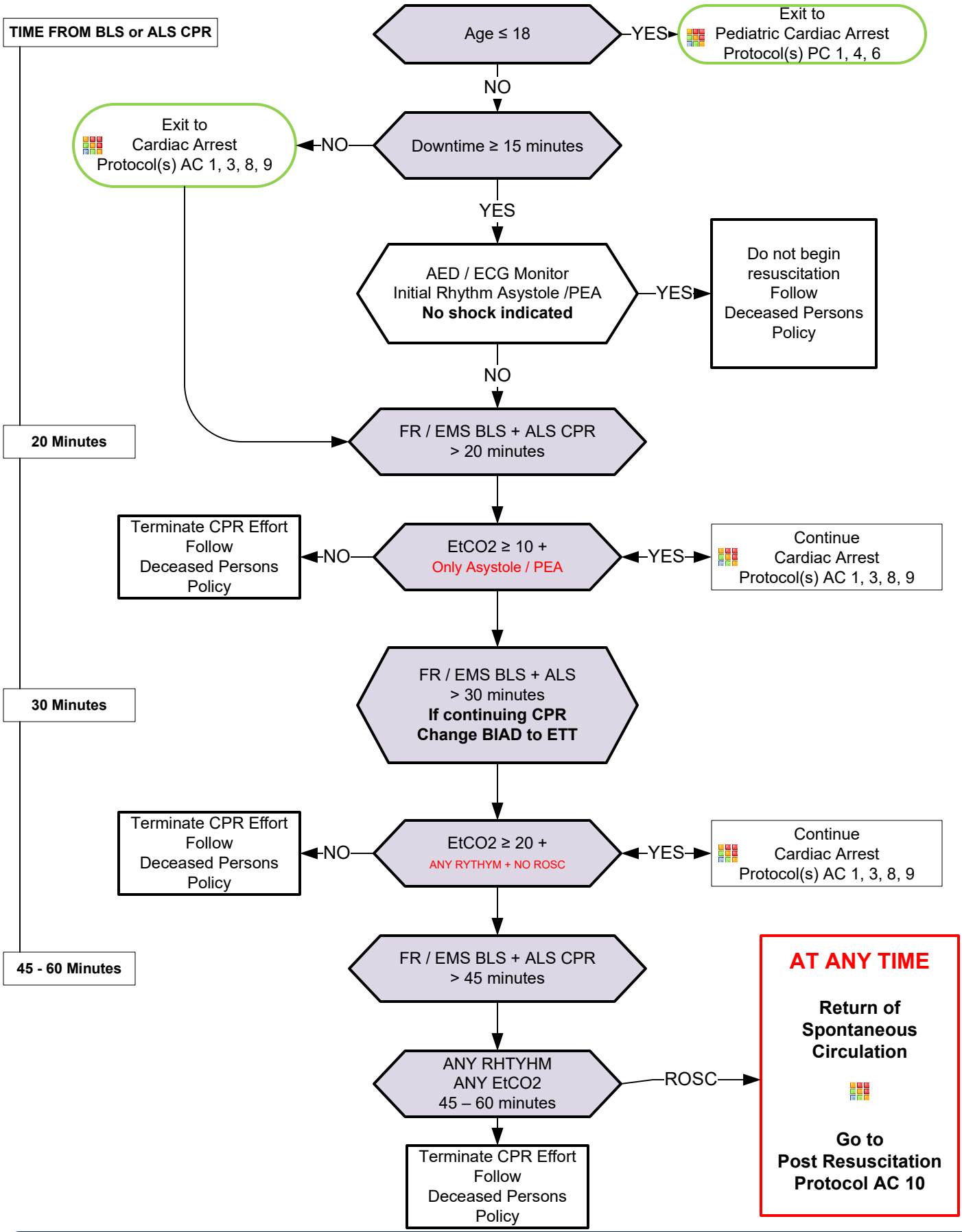
Limit patient movement, work code where found if there is ample space and it is safe to do so.

Mechanical CPR should not be initiated until positions 1-4 are filled.



Pearls
- **This protocol is optional and given only as an example. Agencies may and are encouraged to develop their own.**
- **Team Focused Approach / Pit-Crew Approach recommended; assigning responders to predetermined tasks. Refer to optional protocol or development of local agency protocol.**
- **Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated.**
- **DO NOT HYPERVENTILATE: If no advanced airway (BIAD, ETT), compression to ventilation ratio is 30:2. If advanced airway in place, ventilate 10 breaths per minute with continuous, uninterrupted compressions.**
- **Do not interrupt compressions to place endotracheal tube. Consider BIAD first to limit interruptions.**
- **Passive oxygenation optional in agencies practicing Team Focused Approach / Pit-Crew Approach.**
- Reassess and document BIAD and / or endotracheal tube placement and EtCO2 frequently, after every move, and at transfer of care.
- **IV / IO access and drug delivery are secondary to high-quality chest compressions and early defibrillation**.
- **IV access is preferred route. Follow IV or IO Access Protocol UP 6.**
- **Defibrillation:** Follow manufacture's recommendations concerning defibrillation / cardioversion energy when specified.
  - Charge defibrillator during chest compressions, near the end of 2-minute cycle, to decrease peri-shock pause.
  - Following defibrillation, provider should immediately restart chest compressions with no pulse check until end of next cycle.
- Success is based on proper planning and execution. Procedures require space and patient access. Make room to work.
- Discussion with Medical Control can be a valuable tool in developing a differential diagnosis and identifying possible treatment options.

On Scene Resuscitation
Termination of CPR



On Scene Resuscitation / Termination of CPR

ROSC ALWAYS RESETS THE CLOCK - ALL ROSC TRANSPORTED TO ER AFTER COOL DOWN

Work entire code on scene unless unsafe to do so

Better chance of High Quality CPR while stationary on scene

Likely-hood of meaningful neurological recovery after 45 minutes in arrest is very low
- Exceptions are hypothermic and pediatric arrest scenarios

End Tidal CO2 is affected by Bicarb administration.

AT 45-60 minutes with no ROSC - May terminate with ANY RHYTHM - ANY EtCO2

Pearls

- **General approach:**
  1. **Determine if a terminal disease is involved?**
  2. **Is there an advanced directive such as a DNR / MOST form?**
  3. **Did the patient express to your historian any desires regarding resuscitation and if so what measures?**
  4. **Remember a living will is not a DNR.**
- **Obtain a history while resuscitation efforts are ongoing. Determine the most legitimate person on scene as your information source such as a spouse, child, or sibling or Durable Health Care Power of Attorney.**
- Basic and Advanced Life Support may use for treatment decisions.

Target Temperature Management
(Optional)

History
- Non-traumatic cardiac arrests (drownings and hanging / asphyxiation are permissible in this protocol.)
- All presenting rhythms are permissible in this protocol
- Age 18 or greater

Signs and Symptoms
- Cardiac arrest
- Return of Spontaneous Circulation post-cardiac arrest

Differential
- Continue to address specific differentials associated with the arrhythmia

Return of Spontaneous Circulation ROSC

Criteria for Induced Hypothermia
Initial rectal temperature
≥ 93.2 F (34C)

YES

NO

Exit to Post Resuscitation Protocol AC 10

Agencies utilizing cerebral cooling devices are unlikely to see a change in rectal temperature during transport.

Continued temperature assessment not warranted with these devices. Document initial temperature

B	**Advanced Airway (includes BIAD) in place** with EtCO2 > 20 mmHg
	Airway Protocol(s) AR 1, 2, 3 ***as indicated***
	Post Resuscitation Protocol AC 910 ***as indicated***
	IV / IO Access Protocol UP 6
	Hypotension / Shock Protocol AM 5 ***as indicated***
	Perform Neurological Assessment
	Expose and apply ice packs to axilla and groin areas

Agency Specific Cooling Device

Reassess Rectal Temperature
Target: 89.6 – 96.8 °F
(Range 32 – 36C)

< 89.6° F *(32° C)*

Stop cooling measures
Until temperature increases

Reassess temperature every 10 minutes

Continue Post Resuscitation Care

≥ 89.6° F *(32° C)*

Continue Cooling

Exit to Post Resuscitation Protocol AC 9

Shivering noted

NO

YES

P	**Fentanyl 50 – 75 mcg IV / IO** Repeat every 5 minutes as needed **Maximum 300 mg** **Versed 2 – 2.5 mg IV / IO** Repeat every 5 minutes as needed **Maximum 10 mg** **Vecuronium 10 mg IV / IO** If shivering uncontrolled following Opioid and Benzodiazepine Administration

Notify Destination or Contact Medical Control

Target Temperature Management
(Optional)

Pearls

- **Criteria for Targeted Temperature Mangement:**
  - **Return of spontaneous circulation not related to blunt / penetrating trauma or hemorrhage with ventricular fibrillation / tachycardia and non-shockable arrhythmias.**
  - **Temperature greater than 93.2°F (34° C).**
  - **Advanced airway (including BIAD) in place with no purposeful response to verbal commands.**
  - **Infusion of cold saline is NOT recommended in the prehospital setting.**
- **Hyperventilation is a significant cause of hypotension and recurrence of cardiac arrest in the post resuscitation phase and must be avoided. Titrate FiO_2 to maintain SpO_2 of 92 - 98%.**
- **Pain/sedation:**
  - **Patients requiring advanced airways and ventilation commonly experience pain and anxiety.**
  - **Unrelieved pain can lead to increased catecholamine release, ischemia, immunosuppression, and prolonged hospitalization.**
  - **Ventilated patients cannot communicate pain / anxiety and providers are poor at recognizing pain / anxiety.**
  - **Vital signs such has tachycardia and / or hypertension can provide clues to inadequate sedation, however they both are not always reliable indicators of patient's lack of adequate sedation.**
  - **Pain must be addressed first, before anxiety. Opioids are typically the first line agents before benzodiazepines. Ketamine is also a reasonable first choice agent.**
- **EtCO2 Monitoring:**
  - **Initial End tidal CO2 may be elevated immediately post-resuscitation, but will usually normalize.**
  - **Goal is 35 – 45 mmHg but avoid hyperventilation to achieve.**
- **Titrate fluid resuscitation and vasopressor administration to maintain SBP of > 90 mmHg or Mean Arterial Pressure (MAP) of 65 mmHg.**
- **STEMI (ST-Elevation Myocardial Infarction)**
  - **Consider placing 2 IV sites in the left arm: Many PCI centers use the right radial artery for intervention.**
  - **Consider placing defibrillator pads on patient as a precaution.**
  - **Document and time-stamp facility STEMI notification and make notification as soon as possible.**
  - **Document the time of the 12-Lead ECG in the PCR as a Procedure along with the interpretation (Paramedic).**
- **Consider transport to facility capable of managing the post-arrest patient including hypothermia therapy, cardiology / cardiac catheterization, intensive care service, and neurology services.**
- **Utilization of this protocol mandates transport to facility capable of managing the post-arrest patient and continuation of induced hypothermia therapy.**
- If no advanced airway in place obtained, cooling may only be initiated on order from medical control.
- No evidence suggests improved survival with prehospital cooling.
- The condition of post-resuscitation patients fluctuates rapidly and continuously, and they require close monitoring. Appropriate post-resuscitation management may best be planned in consultation with Medical Control.

Mechanical Circulatory Support
LVAD, RVAD, and Bi-VAD

History
- SAMPLE
- Bridge to transplant
- Destination therapy
- Estimated downtime
- LVAD, RVAD, Bi-Vad, TAH
- DNR, MOST, or Living Will
- Contact with LVAD coordinator

Signs and Symptoms
- Unconsciousness
- Pulseless
- Apneic
- Poor capillary refill / skin color
- AMS or decreased mental status
- No electrical activity on ECG
- No heart tones on auscultation

Differential
- See Reversible Causes below
- Infection/Sepsis
- Hypovolemia
- Cardiac arrest
- Hemorrhage

Contact VAD coordinator:
- As quickly as possible for troubleshooting and treatment advice, but do not delay emergency treatment
- Follow patient specific emergency plan if present

Rapid assessment
Check for signs of life
Assess for adequate perfusion

Criteria for Death / No Resuscitation
Review DNR / MOST Form

YES ▶
Decomposition
Rigor mortis
Dependent lividity
Blunt force trauma
Injury incompatible with life
Extended downtime with asystole

Do not begin resuscitation

Follow Deceased Persons Policy

NO

Unresponsive and Not breathing normally

Responsive or Unresponsive and Breathing normally

Airway Protocol(s) AR 1, 2, 3 ***if indicated***

Respiratory Distress Protocol AR 4 ***if indicated***

Assess LVAD function
Look and listen for alarms
LVAD Alarming?

YES ▶ **Go to Page 2** ◀ YES

NO

Place stethoscope over heart

Humming sound present?

YES ▶ **Go to Page 3** ◀ YES

NO

Airway Protocol(s) AR 1, 2, 3 ***if indicated***

Respiratory Distress Protocol AR 4 ***if indicated***

Assume VAD failure
Initiate age appropriate ventilation rate

Go to Page 2

Mechanical Circulatory Support
LVAD, RVAD, and Bi-VAD

History
- SAMPLE
- Bridge to transplant
- Destination therapy
- Estimated downtime
- LVAD, RVAD, Bi-Vad, TAH
- DNR, MOST, or Living Will
- Contact with LVAD coordinator

Signs and Symptoms
- Unconsciousness
- Pulseless
- Apneic
- Poor capillary refill / skin color
- AMS or decreased mental status
- No electrical activity on ECG
- No heart tones on auscultation

Differential
- See Reversible Causes below
- Infection/Sepsis
- Hypovolemia
- Cardiac arrest
- Hemorrhage

Entering from Page 1
No VAD humming heard and/or
VAD is alarming

Attempt to restart LVAD

Expose VAD control module
Expose VAD power source
Expose VAD driveline

Driveline:
- **Ensure driveline is connected firmly to control module**

Power source (batteries or main power source):
- **Ensure all power connections are firmly connected to control module**

Battery charge:
- **Check by pressing charge indicator**
- **Replace battery(s) if indicated**

LVAD restarted?
Humming sound over heart?

YES → **Go to Page 3**

NO

Spare control module:
- **Attach batteries or main power source to spare control module**
- **Detach driveline and attach to spare control module**

LVAD restarted?
Humming sound over heart?

YES → **Go to Page 3**

NO

Possible driveline cable fracture:
- **Quickly, but gently manipulate cable trying to restore break**
- **If successful, tape driveline in place where functioning restored**

Mechanical Circulatory Support
LVAD, RVAD, and Bi-VAD

Reassess
Patient responsive?

YES → **Rhythm analysis**
Ventricular Tachycardia?
Ventricular Fibrillation?

YES → Do Not Defibrillate

→ **Access Circulation**
- **Cap refill < 2 – 3 sec?**
- **EtCO2 > 20 mmHg?**
- **MAP > 50 mmHg?**

YES → (to VAD Coordinator)

NO → IV / IO Access Protocol UP 6

A	**Normal Saline Bolus 500 mL IV / IO** May repeat as needed **Maximum 2 L**

NO → **Rhythm analysis**
Ventricular Tachycardia?
Ventricular Fibrillation?

YES →

	AED Procedure ***if available***
P	Defibrillation Procedure

NO → **Access Circulation**
- **Cap refill < 2 – 3 sec?**
- **EtCO2 > 20 mmHg?**
- **MAP > 50 mmHg?**

YES →
- **Contact VAD Coordinator**
- **Transport to VAD Center**
- **Take all spare VAD equipment**

Notify Destination or Contact Medical Control

NO →

Cardiac Arrest Protocol AC 3 ***as indicated***
Team Focused CPR Protocol AC 11 ***as indicated***
IV / IO Access Protocol UP 6
A — **Normal Saline Bolus 500 mL IV / IO** May repeat as needed **Maximum 2 L**
Contact VAD Coordinator
On Scene Resuscitation / Termination of Resuscitation Protocol(s) AC 12 ***as indicated***

Reversible Causes
Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypothermia
Hypo / Hyperkalemia

Tension pneumothorax
Tamponade; cardiac
Toxins
Thrombosis; pulmonary (PE)
Thrombosis; coronary (MI)

Suspected Opioid Overdose
Administer Naloxone per Overdose / Toxic Ingestion Protocol TE 7

Left Ventricular Assist Device LVAD Unresponsive or AMS

TRANSPORT TO VAD / ARTIFICAL HEART CENTER - May UTILIZE AEROMEDICAL

Pearls

- **Recommended exam: Mental status, skin color, capillary refill, peripheral pulses, blood pressure.**
- **Assessment of blood flow and perfusion status:**
  - **Optimal BP attained by manual BP and Doppler.**
  - **Automated BP devices can measure a BP in about 50% of attempts and is not reliable to assess perfusion**
  - **A MAP of ≥ 60 mmHg is adequate for most LVAD patients.**
  - **Skin color, skin temperature, capillary refill**
- **Mechanical Circulatory Support devices:**
  - **LVAD – Left Ventricular Assist Device**
  - **RVAD – Right Ventricular Assist Device**
  - **BiVAD – Biventricular Ventricular Assist Device**
  - **TAH – Total Artificial Heart**
- **Reasons for use:**
  - **Bridge therapy – patients awaiting transplant or anticipated recovery.**
  - **Destination therapy – advanced heart failure, not candidate for transplant, and will live rest of life with device.**
- **Pump type and assessing pulses:**
  - **Pulsatile flow pumps – older units, not commonly in use now, but generate blood flow with a pulsatile flow and patient will have a palpable pulse.**
  - **Continuous flow pumps – majority of pumps now used and create blood flow in a continuous stream, no pulsatile flow, so patient will not have a palpable pulse.**
  - **Most devices are implanted inside the chest and have an internal pump, a driveline connected from the pump to the controller unit, and a power source consisting of batteries and electrical cord for receptacles.**
- **Common complications:**
  - **Disconnection of power supply, either battery disconnect, or electrical cord to receptacle disconnection.**
  - **Driveline failure or disconnection from controller unit.**
  - **Controller failure**
  - **Blood clot formation, acute stroke, and bleeding (mucosal and gastrointestinal most common sites)**
  - **Infection**
- Abnormal heart rhythm:
  - Pseudo-PEA: Normal cardiac electrical activity in a patient who is alert and well perfused with no palpable pulse. Tachyarrhythmias are usually well tolerated.
- End Tidal CO2 (EtCO2)
  - If EtCO2 is < 10 mmHg, improve chest compressions. Goal is ≥ 20 mmHg.
  - If EtCO2 spikes, typically > 40 mmHg, consider Return of Spontaneous Circulation (ROSC)
- Transcutaneous Pacing:
  - Pacing is NOT effective in cardiac arrest and pacing in cardiac arrest does NOT increase chance of survival

Total Artificial Heart

History
- SAMPLE
- Bridge to transplant
- Destination therapy
- Estimated downtime
- LVAD, RVAD, Bi-Vad, TAH
- DNR, MOST, or Living Will
- Contact with LVAD coordinator

Signs and Symptoms
- Unconsciousness
- Pulseless
- Apneic
- Poor capillary refill / skin color
- AMS or decreased mental status
- No electrical activity on ECG
- No heart tones on auscultation

Differential
- See Reversible Causes below
- Infection/Sepsis
- Hypovolemia
- Cardiac arrest
- Hemorrhage

Rapid assessment
Check for signs of life
Assess for adequate perfusion

Contact transplant coordinator:
- As quickly as possible for troubleshooting and treatment advice, but do not delay emergency treatment
- Follow patient specific emergency plan if present

DO NOT USE ECG MONITOR
- Total Artificial Heart does not generate ECG

Criteria for Death / No Resuscitation
Review DNR / MOST Form

YES → Decomposition, Rigor mortis, Dependent lividity, Blunt force trauma
Injury incompatible with life
Extended downtime
Do not begin resuscitation
Follow Deceased Persons Policy

NO

Pulse Present?

NO → **Go to Page 2**

YES

- Airway Protocol(s) AR 1, 2, 3 ***if indicated***
- Respiratory Distress Protocol AR 4 ***if indicated***
- Altered Mental Status Protocol UP 4 ***if indicated***

→ **Check Blood Pressure**

Systolic BP ≥ 150 mmHg

A — **Nitroglycerin 0.3 / 0.4 mg SL**
Repeat every 5 minutes as needed

Maintain SBP ≥ 90 mmHg

P — **Furosemide 40 mg IV / IO** ***if available***
May assist patient taking their antihypertensive medication

Maintain SBP ≥ 90 mmHg

Systolic BP < 150 mmHg And ≥ 90 mmHg

DO NOT USE:
- Manual or mechanical chest compressions
- ECG/Defibrillation/Pacing/AED devices
- Vasopressor medications
- Antiarrhythmic medications

Systolic BP < 90 mmHg

- IV / IO Access Protocol UP 6

A — **Normal Saline Bolus 500 mL IV / IO**
May repeat as needed
Maximum 1 L

Notify Destination or Contact Medical Control

Total Artificial Heart

Entering from Page 1
No Pulse Present

DO NOT USE ECG MONITOR
- Total Artificial Heart does not generate ECG

Attempt to restart Total Artificial Heart

Expose Total Artificial Heart control module
Expose Total Artificial Heart power source
Expose Total Artificial Heart driveline

Driveline:
- **Ensure it is connected firmly to control module**
- **Ensure lines are not kinked or bent**

Power source:
- **Ensure all connections firmly to control module (batteries or main power source)**

Battery charge:
- **Check by pressing charge indicator**
- **Replace battery(s) if indicated**

Back up Driver
- **Change to back up driver *if available***

Pulse Present? YES → **Go to Page 1**

NO

A **Normal Saline Bolus 500 mL IV / IO**
May repeat as needed

Maximum 1 L

Pulse Present? YES → **Go to Page 1**

NO

Follow Deceased Persons Policy

Total Artificial Heart

Pearls

- **Recommended exam: Mental status, skin color, capillary refill, peripheral pulses, blood pressure.**
- **Assessment of blood flow and perfusion status:**
  - **Manual and automated BP devices can measure a BP.**
  - **Skin color, skin temperature, capillary refill**
- **ECG and telemetry monitoring:**
  - **The artificial heart does not produre an ECG wave form or tracing.**
  - **Do not use the 12-Lead ECG or ECG monitoring as it will only show asystole.**
- **Total Artificial Heart:**
  - **Different than Ventricular Assist Device (LVAD, RVAD, or Bi-VAD)**
  - **The patient's left and right ventricles are removed and the artificial heart is connected to the right and left atria.**
  - **The patient is totally dependent on the artificial heart for circulatory support – the native heart is removed.**
  - **There are both a right and left side pump, driven by air, and each side driven by a separate driveline.**
  - **The drivelines are not electric, they are driven by air, so kinking can disrupt the pumping action.**
  - **Artificial heart produces a pulsatile wave form so the patient will have a palpable pulse when operational.**
- **Reasons for use:**
  - **Bridge therapy – patients awaiting transplant or anticipated recovery.**
  - **Destination therapy – advanced heart failure, not candidate for transplant, and will live rest of life with device.**
- **Common complications:**
  - **Most common is kinking or bending of the driveline(s) which stops air from moving and stops pumping action.**
  - **Disconnection of power supply, either battery disconnect, or electrical cord to receptacle disconnection.**
  - **Driveline failure or disconnection from controller unit.**
  - **Controller failure**
  - **Blood clot formation, acute stroke, and bleeding (mucosal and gastrointestinal most common sites)**
  - **Infection**
- **Blood pressure:**
  - **Optimal SBP is < 130 mmHg and > 90 mmHg.**
  - **Hypertension puts great strain on the pump and can cause blood to back up into the lungs and cause pulmonary edema and respiratory failure.**
  - **Epinephrine and vasopressors are ineffective, can cause hypertension, and may worsen the patient's condition.**
- Manual or mechanical chest compressions:
  - **Do not use**
- End Tidal CO2 (EtCO2)
  - Helpful in monitoring adequate perfusion status.
- Defibrillation/Cardioversion:
  - Do not use.
- Transcutaneous Pacing:
  - Do not use.

Wearable Cardioverter Defibrillator Vest

History
- SAMPLE
- Known risk for Sudden Cardiac Death
- Risk for life-threatening arrhythmia
- No implanted defibrillator
- Heart failure – cardiomyopathy
- Decreased ejection fraction

Signs and Symptoms
- Chest pain, dyspnea
- Palpitations
- Received shock from vest
- Poor capillary refill / skin color
- AMS or decreased mental status

Differential
- See Reversible Causes below
- Arrhythmia
- Infection/Sepsis
- Hypovolemia
- Cardiac arrest
- Hemorrhage

Conduct standard patient assessment
Primary/Secondary Surveys

Wearable Cardioverter-Defibrillator Vest Alarming?

YES

Device Silent or Single-Tone Gong Alert
Voice: None – silent
Voice: "Treatment given, call your doctor"
See page 2

NO

Device Siren Alert Two-Tone
Voice: "If patient is not responsive, call for help. Start CPR."
See page 2

Device Siren Alert Two-Tone
Voice: "Press response buttons to delay treatment."
"Bystanders, do not interfere."
See page 2

Cardiac Arrest

YES → Cardiac Arrest Protocol AC 3

NO

Condition requires 12-Lead ECG
And/or
Continuous telemetry monitoring

YES
- Airway Protocol(s) AR 1, 2, 3 ***as indicated***
- Chest Pain and STEMI Protocol AC 4 ***if indicated***
- Age Appropriate Protocol(s) ***as indicated***
- IV / IO Protocol UP 6
- **Remove cardioverter-defibrillator vest**
  1. Remove the battery
  2. Remove the vest
  3. Place ECG electrodes
  4. Place pads anterior-lateral or anterior-posterior
- AED Procedure ***if available***
- P: Cardioversion - Defibrillation Procedure(s)
- Cardiac Monitor

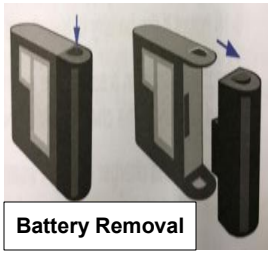
NO

Leave Vest in Place and Operational

Exit to Age Appropriate Protocol(s)

Notify Destination or Contact Medical Control

Wearable Cardioverter Defibrillator Vest



Pearls

- **Recommended exam: Mental status, skin color, capillary refill, peripheral pulses, blood pressure.**
- **Wearable Cardioverter-Defibrillator Vest:**
  - **Device is preparing to delivery a shock to the patient:**
  - **Before device delivers a shock, it tests to see if patient is conscious – voice prompt instructs patient to press the "response" button (see diagram above).**
  - **Only the patient should press the "response" button.**
  - **Once a treatable arrhythmia is detected it takes between 25 and 60 seconds to deliver the shock.**
- **Audible and tactile warning system:**
  - **The device will provide a vibration, a siren tone, and voice prompts to check if the patient is conscious and give them an opportunity to press the "response" button to abort a shock.**
  - **See audible warning system above.**
- **Reasons for use:**
  - **Currently only device on the market is the Zoll LifeVest.**
  - **Worn by patients at risk of sudden cardiac arrest or risk of abnormal and/or lethal arrhythmia.**
- **Blue gel on the patient's skin from the device:**
  - **Electrode pads release a blue get prior to treatment to improve shock conduction and reduce burning.**
  - **Do not remove the gel if the vest is left in place during treatment.**
  - **Remove gel if vest is removed for prehospital care.**
- **Shock to providers:**
  - **Do not touch the patient when the device is instructing you that a shock will be delivered.**
  - **Providers can be shocked by the device during energy delivery if provider is touching the patient.**
- Removing the device for prehospital care:
  - The device should only be removed when ECG monitor and defibrillator is available.
  - Continuous ECG monitoring and electrode pads should be in place when vest is removed.
- Defibrillation/cardioversion with vest in place:
  - Disconnect the device from the vest before you deliver a cardioversion or defibrillation
- Transcutaneous Pacing:
  - May be utilized with vest in place – disconnect the device from the vest before you perform transcutaneous pacing.