

MODULE 5





North Carolina EMS State Protocols Cardiac Arrest Protocol

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Objectives:

- Review 2012 NCCEP EMS Cardiac Protocols
 - Cardiac Arrest
 - PEA / Asystole / VF-VT
- Highlight updates consistent with AHA recommendations



Disclaimer:

- 2012 NCCEP EMS Protocols are currently in public comment
- Final draft version approved by NCCEP Board of Directors
- Final version WILL change based on public comment



TEAM FOCUSED-PIT CREW APPROACH




Team Focused-Pit Crew:

- Recommends concept / Not mandated (Optional Protocol)
- Responders assigned tasks based on arrival sequence or seat assignment with career agencies
 - Works with volunteer and career agencies




Team Focused-Pit Crew:

- Focus on Compression Only CPR initially
- Focus on high quality, continuous, uninterrupted compressions
- Focus on Early Defibrillation / AED

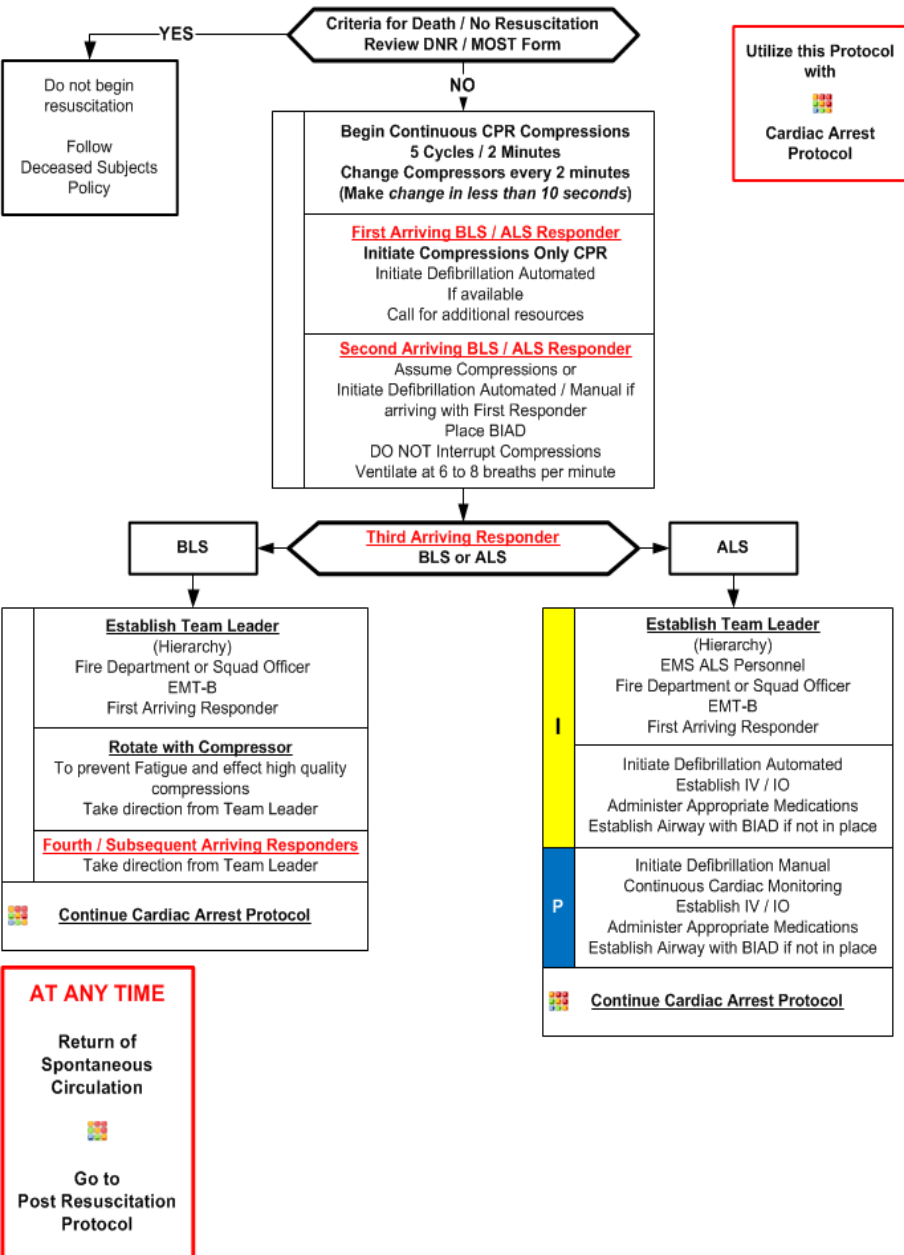


Team Focused-Pit Crew:



- Focus on insertion of BIAD and not interrupting compressions to effect intubation
- Focus on prevention of hyperventilation / oxygenation
 - Maintain oxygen saturation at 94 % or >

Team Focused CPR



Protocol

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Team Focused CPR

Primary focus is on quality, continuous and uninterrupted compressions at a rate of at least 100 / minute. Depth should be at least 2 inches in the adult and should allow for complete chest recoil. Compressor cycle changes and pulse checks should be done together and take no longer than 5 seconds each.

Best chance of survival is quality compressions and early defibrillation. After compressions are initiated and defibrillation performed (if indicated) then the airway can be addressed. When the adult suffers a primary cardiac arrest it takes about 10 to 15 minutes before they will de-saturate below 80 %. Hyperventilation / hyper-oxygenation demonstrate worse outcomes in the adult.

Patients in whom a primary cardiac event DID NOT lead to their arrest such as drowning, respiratory arrest, trauma or drug overdose then the airway and oxygenation will assume more importance early on in the resuscitation effort.

Typical Tiered Response:

First Arriving BLS / MR: Initiate Compression Only CPR and call for help / notify of CPR.

Second Arriving BLS / MR: Assume compressions if First Responder has compressed longer than 2 minutes otherwise will initiate Defibrillation Automated Procedure if available. Depending on time spent during compressions First or Second Responder will place BIA without interrupting compressions, place ResQPod and turn on visible Red Light Metronome and ventilated as directed.

Third Arriving BLS / MR: Allows establishment of Team Leader. Third Arriving may be Team Leader or take direction from Team Leader.

Team Leader: Responsible for ensuring High Quality / Continuous / Uninterrupted Compressions, change in compressors every 2 minutes and ensure the patient is not being hyperventilated which leads to poor outcomes. Also responsible for talking with family and ensuring they are aware there family member has no pulse and is not breathing so they are in effect DEAD. Ensure them that everything that can be done is being performed now. Be respectful, direct and compassionate as well as honest. They have a very poor chance of survival, typically < 5 %.

Fire Department / Squad Officer: In addition to Team Leader. CPR should be managed like any other Fire Scene. Personnel not immediately needed should be moved to a staging area and summoned when needed. This decreases confusion and noise on scene and limits the overwhelming environment the family is likely already experiencing.

ALS On Scene First:

ALS Team Leader is established. ECG monitor / Quick Look is established and Defibrillation Manual Procedure is initiated if applicable. Compressions are initiated, IV / IO procedure performed and medications are administered per appropriate protocol. BIA is placed. Arriving personnel are directed to tasks.

Location of CPR Effort:

Resuscitation effort should be performed where the patient is found. A safe location with ample space should be sought but patient movement should be limited as this interrupts compressions. If arrest occurs in a public place then every effort will be made to maintain patient dignity. Move to unit only if necessary. Resuscitation effort should be done on scene rather than during transport as this degrades our performance and places you and the public at unnecessary risk of injury. If a family insists on transport then this will be done in a non-emergency fashion to limit injury risk and enable us to maximize our compression quality.

Movement of patient if needed: A coordinated effort will be employed when moving a patient undergoing CPR. The team leader should make sure everyone is prepared for the move and this should occur when a planned compressor cycle change is indicated. Brief movements of short distances should be interspersed with 2 minutes of compressions. Moves optimally should not take more than 10 seconds each.

Talking with Family:

Most important aspect. People don't remember your great intubation or EJ but they will always remember how you interacted with them. Be honest, be straightforward and do not be technical. Begin to gather the information they know and start your explanation from that point. Be very clear the patient is not breathing and their heart is not beating which means they are dead (use the word dead.) Explain what is being done and allow the family to be present for the resuscitation if they desire. Ensure them that all that can be done is being done right now and that transporting will actually worsen their loved ones chance of survival. Let them know that after 30 minutes if we have no response then we should stop as the chance of survival now is less than 1 %.

Pearls

- Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated. Consider early IO placement if available and difficult IV anticipated.
- **DO NOT HYPERVENTILATE:** If no advanced airway (BIA, ETT) compressions to ventilations are 30:2. If advanced airway in place ventilate 8 – 10 breaths per minute.
- Do not interrupt compressions to place endotracheal tube. Consider BIA first to limit interruptions.
- Success is based on proper planning and execution. Procedures require space and patient access. Make room to work.

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ADULT CPR PROTOCOL



Adult CPR Protocol:

- Emphasize Compressions First
- High quality, continuous, uninterrupted compressions
- Focus on Early Defibrillation / AED
- Change Compressors every 2 Minutes
- Limit Interruptions < 10 Seconds



Adult CPR Protocol:

- Emphasizes initial inquiry about DNR / MOST forms
- Adds caveat concerning Maternal Arrest
 - Manual Left Uterine Displacement
- Emphasizes IO early



Cardiac Arrest; Adult



Adult Cardiac Arrest



History

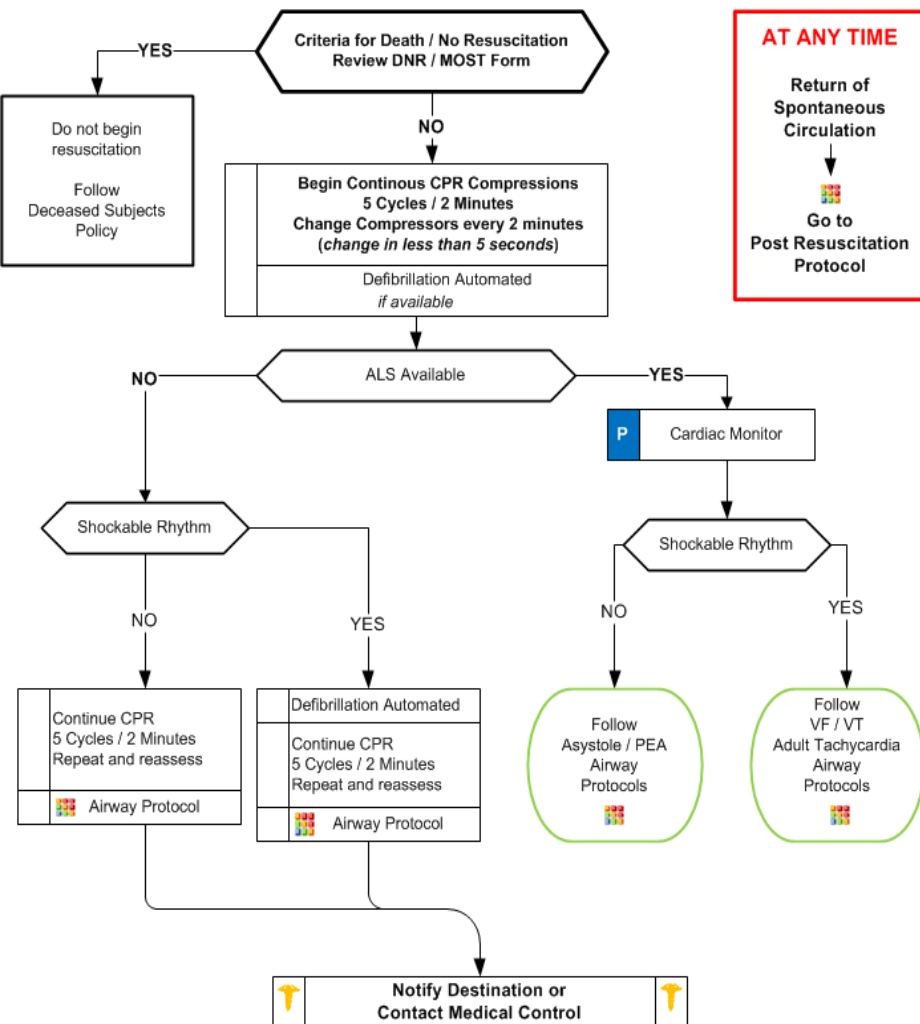
- Events leading to arrest
- Estimated downtime
- Past medical history
- Medications
- Existence of terminal illness

Signs and Symptoms

- Unresponsive
- Apneic
- Pulseless

Differential

- Medical vs. Trauma
- VF vs. Pulseless VT
- Asystole
- PEA
- Primary Cardiac event vs. Respiratory arrest or Drug Overdose



AT ANY TIME

Return of Spontaneous Circulation

Go to Post Resuscitation Protocol

Protocol assumes cardiac etiology leading to arrest.

About 85% of adult cardiac arrest victims have a primary cardiac etiology.

Primary focus is on quality, continuous and uninterrupted compressions at a rate of at least 100 / minute. Depth should be at least 2 inches in the adult and should allow for complete chest recoil. Compressor cycle changes and pulse checks should be done together and take no longer than 5 seconds each.

Best chance of survival is quality compressions and early defibrillation. After compressions are initiated and defibrillation performed (if indicated) then the airway can be addressed. When the adult suffers a primary cardiac arrest it takes about 10 to 15 minutes before they will desaturate below 80 %. Hyperventilation / hyper-oxygenation demonstrate worse outcomes in the adult.

Patients in whom a primary cardiac event DID NOT lead to their arrest such as drowning, respiratory arrest, trauma or drug overdose then the airway and oxygenation will assume more importance early on in the resuscitation effort.

Team Focused CPR: Follow Team Focused CPR protocol.

Location: Resuscitation effort should be performed where the patient is found. A safe location with ample space should be sought but patient movement should be limited as this interrupts compressions. If arrest occurs in a public place then every effort will be made to maintain patient dignity. Move to unit only if necessary. Resuscitation effort should be done on scene rather than during transport as this degrades our performance and places you and the public at unnecessary risk of injury. If a family insists on transport then this will be done in a non-emergency fashion to limit injury risk and enable us to maximize our compression quality.

Movement of patient if needed: A coordinated effort will be employed when moving a patient undergoing CPR. The team leader should make sure everyone is prepared for the move and this should occur when a planned compressor cycle change is indicated. Brief movements of short distances should be interspersed with 2 minutes of compressions. Moves optimally should not take more than 10 seconds each.

Termination: If after 30 minutes of quality resuscitation effort and no Return of Spontaneous Circulation occurs the team leader should inform the family of the situation and consider termination of resuscitation on scene.

Pearls

- Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated. Consider early IO placement if available and difficult IV anticipated.
- **DO NOT HYPERVENTILATE:** If no advanced airway (BIAD, ETT) compressions to ventilations are 30:2. If advanced airway in place ventilate 8 – 10 breaths per minute.
- Do not interrupt compressions to place endotracheal tube. Consider BIAD first to limit interruptions.
- Success is based on proper planning and execution. Procedures require space and patient access. Make room to work. Consider Team Focused Approach assigning responders to predetermined tasks.
- Reassess and document endotracheal tube placement and EtCO2 frequently, after every move, and at transfer of care.
- Defibrillation energy should be at manufacturer's recommendation, maximum energy if unknown.
- **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.
- Consider mechanical CPR (compression) device if available.



ADULT PEA / ASYSTOLE



Adult PEA / Asystole:



- Combined PEA and Asystole
- Atropine removed from routine use
- Added:
 - Beta / Calcium Channel blocker OD
 - Toxicology consideration
 - Renal dialysis consideration



Adult PEA / Asystole:

- Emphasize Compressions First
- High quality, continuous, uninterrupted compressions
- Compressor change every 2 minutes
- Limit compressor interruptions to less than 10 seconds

Adult Asystole / Pulseless Electrical Activity

History

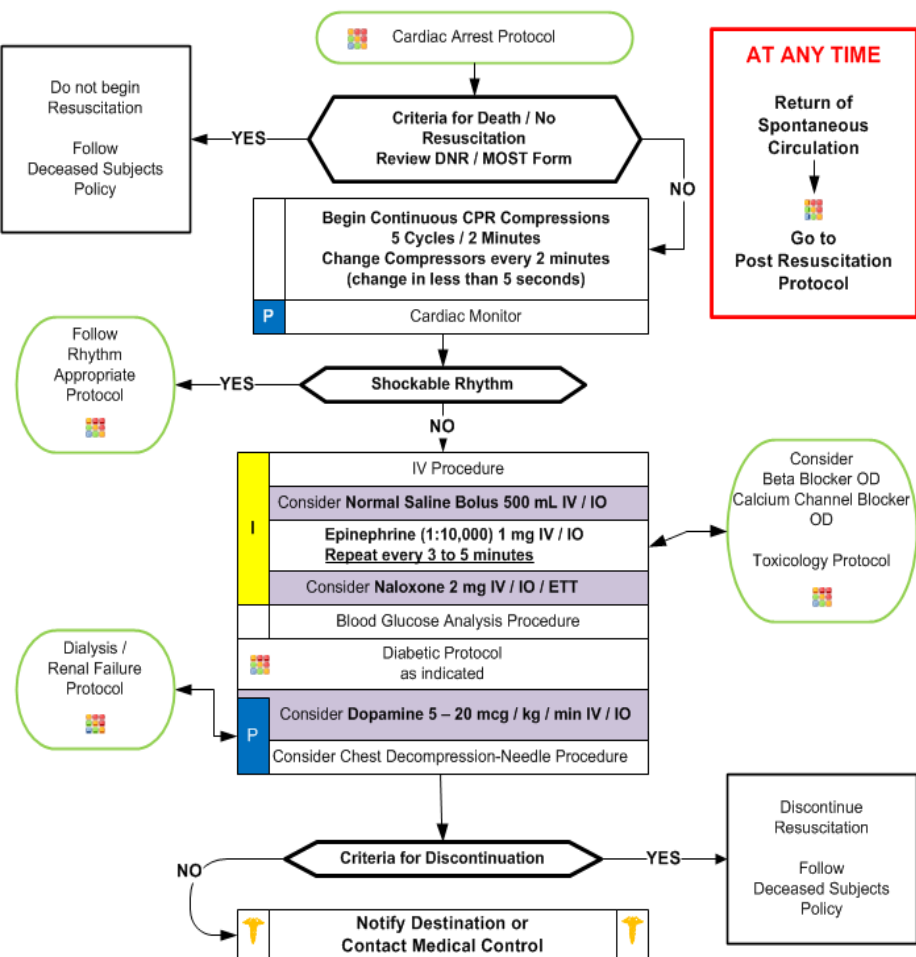
- Past medical history
- Medications
- Events leading to arrest
- End stage renal disease
- Estimated downtime
- Suspected hypothermia
- Suspected overdose
 - Tricyclics
 - Digitalis
 - Beta blockers
 - Calcium channel blockers
- DNR, MOST, of Living Will

Signs and Symptoms

- Pulseless
- Apneic
- Electrical activity on ECG
- No heart tones on auscultation

Differential

- Hypovolemia (Trauma, AAA, other)
- Cardiac tamponade
- Hypothermia
- Drug overdose (Tricyclics, Digitalis, Beta blockers, Calcium channel blockers)
- Massive myocardial infarction
- Hypoxia
- Tension pneumothorax
- Pulmonary embolus
- Acidosis
- Hyperkalemia



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Adult Asystole / Pulseless Electrical Activity

When faced with either PEA or Asystole the most important aspect is finding a reversible cause.

Consider is this a primary cardiac event or a primary respiratory event, drug overdose, drowning or trauma?

Atropine is not likely beneficial and no longer indicated with PEA or Asystole but can be given at the discretion of the team leader to a maximum of 3 mg.

Epinephrine should be given as quickly as possible once IV / IO access is gained.

Reversible causes include:

Hypovolemia	Tension pneumothorax
Hypoxia	Tamponade; cardiac
Hydrongen ion (acidosis)	Toxins
Hypothermia	Thrombosis; pulmonary (PE)
Hypo / Hyperkalemia	Thrombosis; coronary
Hypoglycemia	

Hyperkalemia: Unknown in field setting. End stage renal dialysis patient is at risk and Sodium bicarbonate and Calcium chloride should be given.

ECG findings may not reflect common teaching such as peaked T waves. PEA with a bizarre or widened complex may indeed be hyperkalemia.

Toxicology:

Consider Calcium Channel Blocker (CCB) and Beta Blocker (BB) overdose with PEA and asystole.

If suspected BB overdose give Glucagon 3 mg IV. If you see ECG improvement you may repeat and then contact medical control. Large doses of Glucagon may be needed.

Calcium Chloride (or Ca gluconate) may be beneficial in BB overdose. If suspected CCB overdose administer 1 amp of Calcium Chloride over 3 minutes. If you see ECG improvement you may repeat and then contact medical control.

Pearls

- **Recommended Exam: Mental Status**
- Consider each possible cause listed in the differential: Survival is based on identifying and correcting the cause!
- Discussion with Medical Control can be a valuable tool in developing a differential diagnosis and identifying possible treatment options.

Protocol 29



ADULT VF / VT



Adult VF / VT:

- Emphasize Compressions First
- High quality, continuous, uninterrupted compressions
- Compressor change every 2 minutes
- Limit compressor interruptions to less than 10 seconds

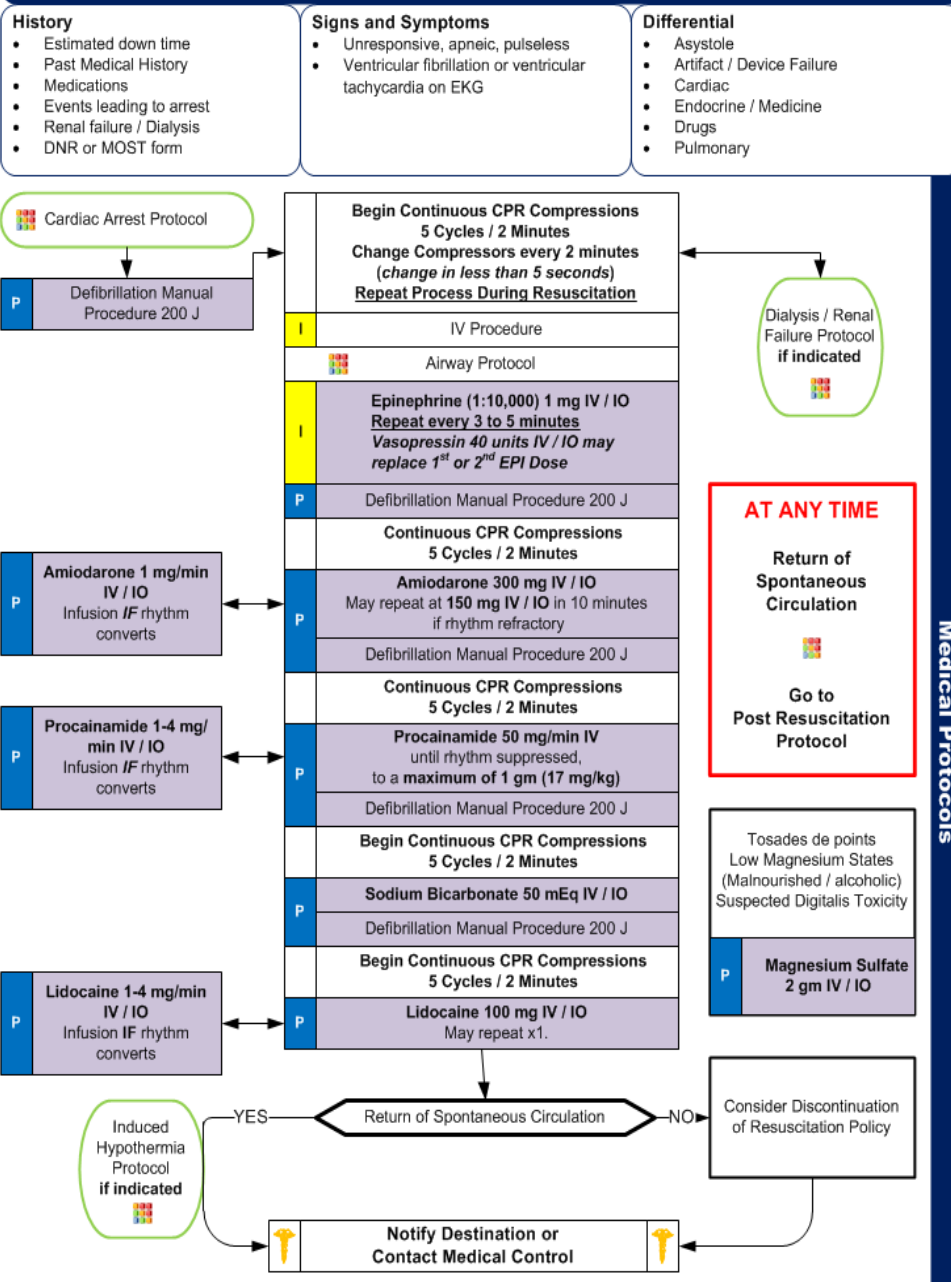


Adult VF / VT:

- Added medication drips to protocol
- Added Renal dialysis consideration
- Added Torsade de Points consideration / Magnesium Sulfate

Ventricular Fibrillation Pulseless Ventricular Tachycardia

Ventricular Fibrillation Pulseless Ventricular Tachycardia



Primary focus is on quality, continuous and uninterrupted compressions at a rate of at least 100 / minute. Depth should be at least 2 inches in the adult and should allow for complete chest recoil. Compressor cycle changes and pulse checks should be done together and take no longer than 5 seconds each.

Best chance of survival is quality compressions and early defibrillation. After compressions are initiated and defibrillation performed then the airway can be addressed. When the adult suffers a primary cardiac arrest it takes about 10 to 15 minutes before they will de-saturate below 80 %. Hyperventilation / hyper-oxygenation demonstrate worse outcomes in the adult.

Dialysis patients:
Refer to Dialysis / Renal Failure protocol early on in the resuscitation. Give sodium bicarbonate and calcium. They should not be given in succession however without appropriate flushing of catheter as they may precipitate. Given in separate IV lines if available.

Magnesium Sulfate:
Give magnesium early on in the resuscitation if patients with suspected low magnesium states. Chronic alcoholics or those who appear malnourished are most at risk. In suspected digitalis toxicity should give early as well. Any patient on digitalis who complains of weakness, nausea and / or vomiting or new confusion pre-arrest may have digitalis toxicity.

Pearls

- Recommended Exam: Mental Status
- Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated. Consider early IO placement if available and difficult IV anticipated.
- DO NOT HYPERVENTILATE: If no advanced airway (BIAD, ETT) compressions to ventilations are 30:2. If advanced airway in place ventilate 8 – 10 breaths per minute.
- Do not interrupt compressions to place endotracheal tube. Consider BIAD first to limit interruptions.
- If no IV / IO, drugs that can be given down ET tube should have dose doubled and then flushed with 5 ml of Normal Saline. IV/IO is the preferred route when available.
- Reassess and document endotracheal tube placement and EtCO2 frequently, after every move, and at transfer of care.
- Do not stop CPR to check for placement of ET tube or to give medicines.
- If arrest not witnessed by EMS then 5 cycles of CPR prior to 1st defibrillation.
- Defibrillation energy should be at manufacturer's recommendation, maximum energy if unknown.
- Effective CPR and prompt defibrillation are the keys to successful resuscitation.
- If BVM is ventilating the patient successfully, intubation should be deferred until rhythm has changed or 4 or 5 defibrillation sequences have been completed.

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Any local EMS System changes to this document must follow the NC OEMS Protocol Change Policy and be approved by OEMS



INDUCED HYPOTHERMIA



Induced Hypothermia:

- Optional protocol
- Added based on available evidence of improved outcomes in selected patient populations

Induced Hypothermia

History

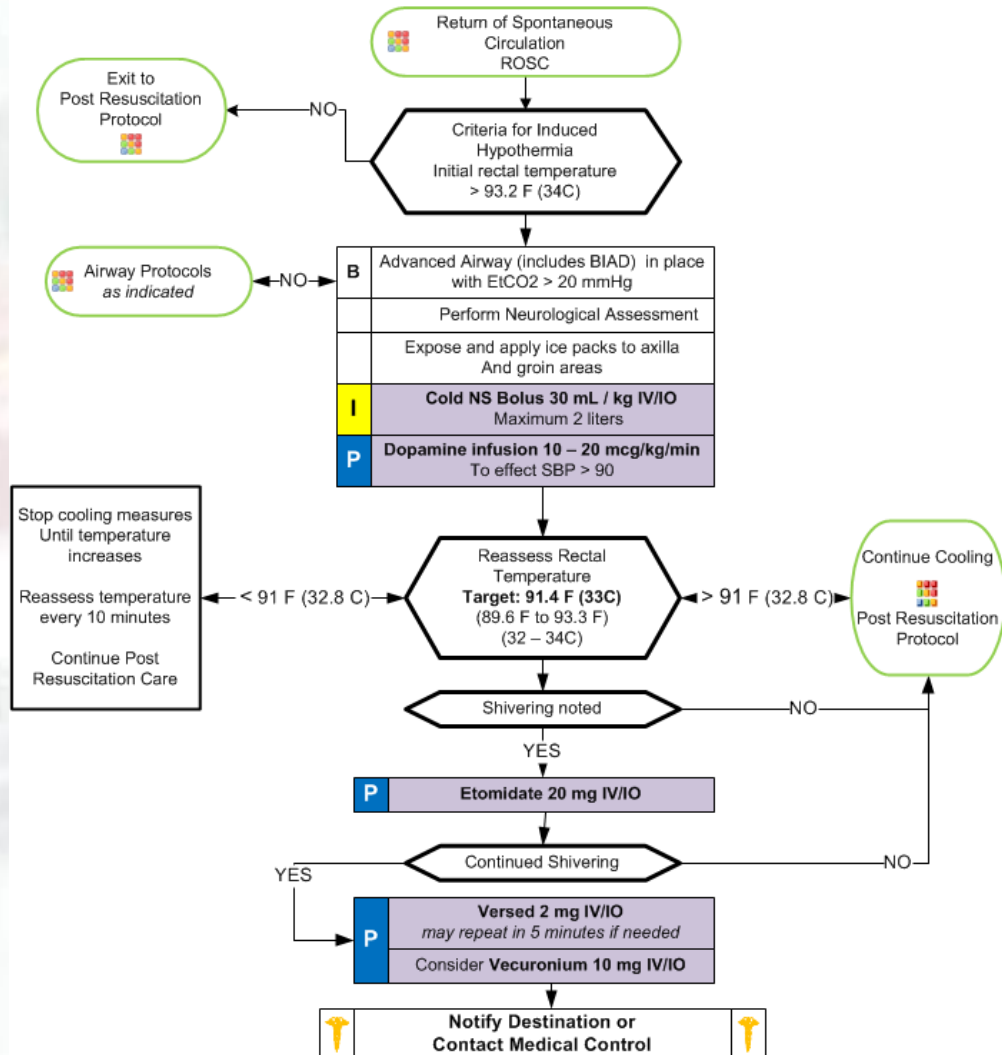
- Non-traumatic cardiac arrests (drownings and hanging / asphyxiation are permissible in this protocol.)
- All presenting rhythms are permissible in this protocol
- Age 18 or greater

Signs and Symptoms

- Cardiac arrest
- Return of Spontaneous Circulation post-cardiac arrest

Differential

- Continue to address specific differentials associated with the arrhythmia



Section Title

Protocol (Insert Number Here)

2012



POST-RESUSCITATION PROTOCOL



Post-Resuscitation Care:



- Maintain oxygen saturation at 94 % or greater but avoid hyperventilation and hyperoxygenation
- Optimize cardiopulmonary function
- Optimize vital organ perfusion



Post-Resuscitation Care:

- Identify and treat STEMI
- Control temperature
- Transport to appropriate hospital with comprehensive post-cardiac arrest treatment

Post Resuscitation

History

- Respiratory arrest
- Cardiac arrest

Signs/Symptoms

- Return of pulse

Differential

- Continue to address specific differentials associated with the original dysrhythmia

Repeat Primary Assessment

B	Optimize Ventilation and Oxygenation
	<ul style="list-style-type: none"> Maintain SpO2 at 94 % or greater Advanced airway if indicated ETCO2 ideally 35 – 40 mm Hg Respiratory Rate <12
	DO NOT HYPERVENTILATE
	I IV / IO Procedure
	B 12 Lead ECG Procedure
P	Cardiac Monitor
	Monitor Vital Signs / Reassess

Arrhythmias are common and usually self limiting after ROSC



If Arrhythmia Persists follow Rhythm Appropriate Protocol

I	Normal Saline Bolus 500 mL IV / IO May repeat to 1 L if lungs remain clear
P	Dopamine 5 – 10 mcg /kg /min IV / IO Titrate to SBP of 90 or greater

YES

Hypotension
Systolic BP 89 or less

NO

Follows
Commands

Induced
Hypothermia
Protocol
if available

STEMI
or
Suspicion of MI

Chest Pain /
STEMI Protocol
STEMI
Destination Plan

NO

Symptomatic
Bradycardia

Bradycardia
Protocol

NO

ROSC After
Defibrillation and
NO
Antiarrhythmic

Amiodarone 150 mg IV / IO
Over 10 minutes
Follow with infusion
1mg / min

Continue Antiarrhythmic
Utilized
Refer to Adult Tachycardia
Protocol

Versed 2 mg IV / IO if needed
Vecuronium 10 mg IV / IO if needed

**Notify Destination or
Contact Medical Control**

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Post Resuscitation

Immediate concerns following Return of Spontaneous Circulation:

- Optimize oxygenation and ventilation to maintain oxygen saturation at 94 % or greater. Hyperventilation must be avoided due to induced hypotension, decreased cardiac output and oxygen injury.
- Optimize cardiopulmonary function and vital organ perfusion.
- Control body temperature and induce therapeutic hypothermia unless contraindicated.
- Search for and treat correctable causes:

Hypovolemia	Tension Pneumothorax
Hypoxia	Tamponade; cardiac
Hydrogen ion (acidosis)	Toxins / Ingestions
Hypo / Hyperkalemia	Thrombosis; pulmonary
Hypothermia	Thrombosis; coronary
Hypoglycemia	
- Identify and treat STEMI
- Transport to facility capable of caring for post arrest patients.

Pearls

- Recommended Exam: Mental Status, Neck, Skin, Lungs, Heart, Abdomen, Extremities, Neuro**
- Hyperventilation is a significant cause of hypotension and recurrence of cardiac arrest in the post resuscitation phase and must be avoided at all costs.
- Most patients immediately post resuscitation will require ventilatory assistance.
- 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.
- Common causes of post-resuscitation hypotension include hyperventilation, hypovolemia, pneumothorax, and medication reaction to ALS drugs.
- Titrate Dopamine to maintain MAP >90. Ensure adequate fluid resuscitation is ongoing.

Protocol 27

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Summary:

- All ACLS / PALS protocols updated to 2010 AHA recommendations
- Aggressive Cardiac Arrest Care
- Aggressive Post-Resuscitation Care