



Emergency Neurological Life Support Resuscitation Following Cardiac Arrest Protocol Version 4.0

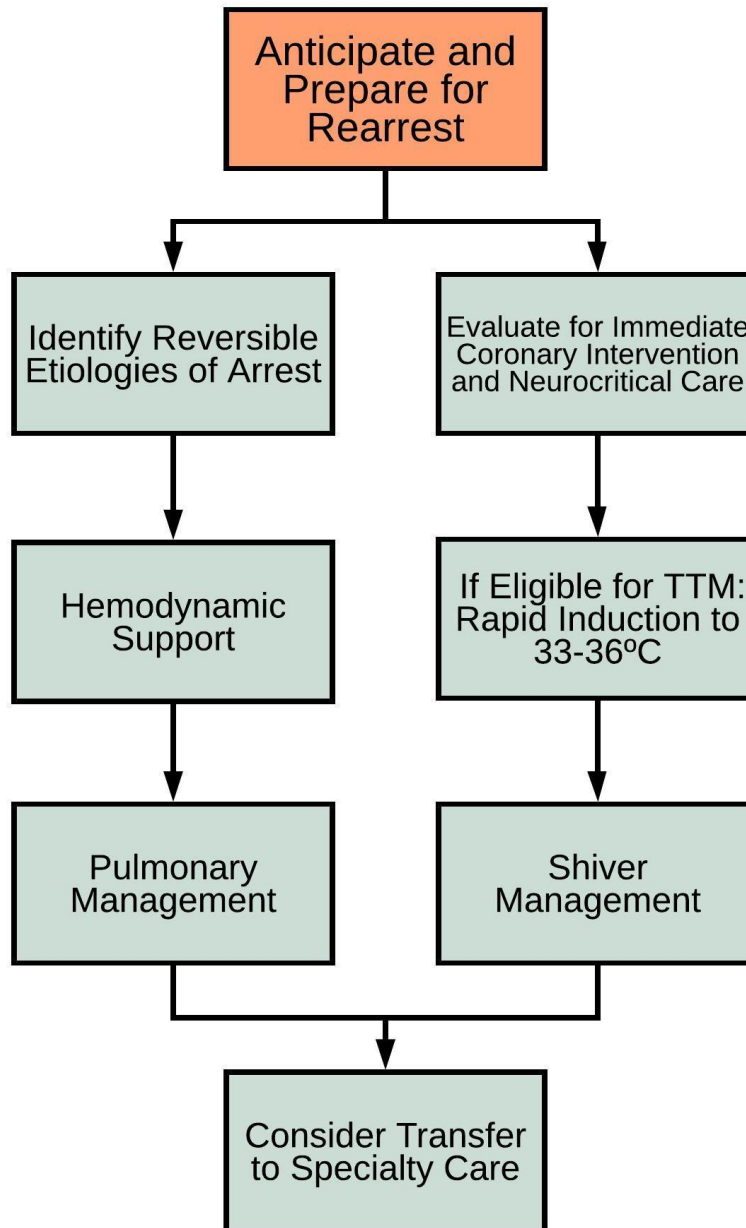
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Resuscitation Following Cardiac Arrest Algorithm (click each box for details)



Checklist and Communication

Checklist

- Initiate hemodynamic and ventilator support
- Assess for common treatable causes of arrest, consider coronary angiography
- Assess eligibility for targeted temperature management
- Begin induction to target temperature
- Consider transfer to specialty center

Communication

- Patient age, pre-arrest circumstances
- Duration of CA and initial arrest rhythm
- Most likely etiology of arrest, if known
- Neurological examination on first assessment
- PCI eligibility
- Time hypothermia started and/or target temperature reached
- Current core temperature
- Current drug infusions (especially sedative and vasoactive agents)

Sample Sign-off Narrative

Prehospital to ER:

I am signing out a 58-year-old man with known hypertension who collapsed with co-workers while walking to lunch. CPR was started by co-workers, an AED was applied and patient found to have a shockable rhythm. He was shocked once by the AED. EMS arrived approximately 10 min later. He was found to be in ventricular tachycardia, and he received 1 mg of epinephrine and was shocked again. ROSC after approximately 18 min. After ROSC, we obtained an EKG and the patient was found to have ST elevation in leads V3-V6. He has an LMA and oxygen saturation is 100%. Blood pressure is 130/85 mm Hg and he is now in sinus tachycardia at 108 beats/min.

ER to ICU:

58-year-old man with out of hospital CA with ROSC obtained at 18 min. He was found to have a STEMI and underwent PCI with stenting of a proximal LAD occlusion. He received heparin, aspirin, and prasugrel in the cath lab. On his initial neurological examination post-cath GCS was 5 (E1V1M3). TTM was started with a target temperature of 36 °C. Target temperature was achieved 45 min later at 14:10. Current temperature is 36.1 °C with a gel adhesive pad cooling device applied. The patient is currently on 2mcg/kg/min of norepinephrine. He received a single dose of cisatracurium at the initiation of TTM with 2gm of magnesium and 150mcg of fentanyl. Fentanyl is ordered PRN for shivering along with the TTM and shivering management order set.

Anticipate and Prepare for Potential Rearrest

Patients resuscitated from cardiac arrest are among the sickest encountered by most intensive care providers. During and immediately after a cardiac arrest, several parallel workflows are necessary to support successful resuscitation. Concurrently with CPR and stabilization, providers should diligently search for the underlying etiology of arrest. In parallel with cardiopulmonary stabilization, efforts must be taken to minimize the risk of secondary brain injury. Patient who remain comatose following return of spontaneous circulation are likely to benefit from targeted temperature management. They may also benefit from transfer to specialty care. This protocol addresses initial patient stabilization and assessment, induction of targeted temperature management in eligible patients, and shivering management. This protocol does not address the standard ACLS protocols for cardiac resuscitation.

- Approximately 20% of patients rearrest within minutes of initial restoration of pulses.
- Even without frank rearrest, anticipate the likelihood of hemodynamic instability.
- Patients resuscitated from cardiac arrest typically require intubation, mechanical ventilation, close cardiac and invasive hemodynamic monitoring, and attentive general critical care.
- Many patients will require titration of fluids, vasopressors, administration of antidysrhythmics, etc., in the minutes after initial resuscitation.
- Blood pressure and oxygenation goals should be chosen to maintain cerebral perfusion and prevent secondary brain injury.

Identify Reversible Etiologies of Arrest

- Concurrently with CPR and stabilization, providers should diligently search for the underlying etiology of arrest
- Diagnostic evaluation after ROSC may include a focused history, physical examination, electrocardiogram (EKG) and judicious imaging, and prioritize identification of those etiologies that require specific time-sensitive interventions beyond general resuscitative measures.
- Specific etiologies of arrest requiring emergent treatment include:
 - Acute coronary syndrome/myocardial infarction
 - Arrhythmia
 - Intracranial hemorrhage
 - Pulmonary embolism
 - Trauma
 - Hemorrhage (e.g. GI bleed)
 - Toxicological causes/overdose
 - Septic shock
 - Anaphylaxis

Hemodynamic Support

Maintain

- Identify and treat hypotension and keep MAP >80 mmHg
- Volume resuscitation and blood pressure goals with cerebral perfusion and prevention of secondary brain injury in mind
- Rapid PCI when patient is identified as a candidate for intervention

Pulmonary Management

- Secure airway
- Temperature correct ABG while patient is on TTM
- Rapidly identify and correct hypoxia
- Maintain PaO₂ 80-120 mmHg
- Maintain PaCO₂ ≥ 40 mmHg
- Avoid hyperoxia

Evaluate for Immediate Coronary Intervention

Does the patient need coronary intervention?

- Coronary angiography should be considered for patients with clinical suspicion for an acute coronary syndrome based on EKG (e.g. ST segment changes) or history (e.g. initial shockable rhythm, no other obvious etiology of arrest).
- TTM is not a contraindication for coronary angiography.
- Patients with initial evidence of devastating brain injury (e.g. diffuse cerebral edema on initial brain imaging) are unlikely to benefit from coronary revascularization.

If Eligible for Targeted Temperature Management

Rapid induction to 33-36°C

The patient is eligible for TTM if she/he:

- Suffered a cardiac arrest
- Has return of spontaneous circulation
- Does not follow commands.
- Choose target temperature (33-36°C)

Absolute contraindications:

- DNR/POLST indicating they would not want this level of treatment
- Following commands

If no absolute contraindications, consider the following minor contraindications when determining what temperature to target in each individual patient:

TTM at 36°C is preferred in case of:

- Active bleeding with the cause not (yet) under control
- Greatly increased risk of bleeding (e.g. injury of the spleen or liver)
- Traumatic etiology of cardiac arrest
- Anticipated hemorrhagic diathesis
- Cardiac arrest more than 12 hours ago

After considering risks and benefits:

- Set Target Temperature to 33°C or 36.0°C

If eligible for TTM: rapid induction to 33-36°C

- Core temperature monitoring
- Combine several cooling induction methods, particularly if targeting 33°C, including cold saline and application of temperature control device*
- Sedation
- Monitor for and management of shivering

*Cold saline is **not** recommended in the prehospital setting

Shiver Management

- Monitor for shivering
- Treat shivering when present using a multi-modal approach
 - Skin counter-warming
 - Acetaminophen, magnesium, sedation
 - Intermittent dosing of paralytics may be considered if shivering is refractory to other treatment
- See ENLS protocol Pharmacotherapy-Shivering Protocol

Consider Transfer to Specialty Care

- Post-arrest patients cared for at high-volume centers have improved short- and long-term outcomes.
- Transfer of comatose post-arrest patients to a specialty center offering PCI, cardiac critical care, TTM, and neurocritical care may be prudent.
- Active engagement of a critical care transport physician should be considered when arranging interfacility transport of unstable patients resuscitated from cardiac arrest to ensure adequate resources are mobilized for patient transport.