

POST-RESUSCITATION INDUCED HYPOTHERMIA GUIDELINES

- 2. PURPOSE
INDICATIONS / CONTRAINDICATIONS

- 3-5. DETAILED TIME-LINE FOR INDUCED HYPOTHERMIA
PROTOCOL

- 6-7 APPENDIX – GENERAL GUIDELINES FOR POST-RESUSCITATION
CARE

- 8-17 CLINICAL DATA FORMS
SCREENING DATA
BASELINE CLINICAL DATA
WHEN TEMPERATURE REACHES $<34^{\circ}\text{C}$
6 HOUR DATA
12 HOUR DATA
18 HOUR DATA
24 HOUR DATA
WHEN TEMPERATURE REACHES $>36^{\circ}\text{C}$
DAILY ASSESSMENT
TEMPERATURE GRIDS

PURPOSE

- Brain temperature during the first 24 hours after resuscitation from cardiac arrest has a large effect on survival and neurological recovery.
 - Cooling to 32-34°C for 24 hours decreases chance of death (OR 0.74 [0.58,0.95]) and increases chance of good neurological recovery (OR 1.40 [1.08,1.81]) (Sterz et al., NEJM 346: 549-556, 2002).
 - Cooling to 32-34°C for 12 hours increases chance of good neurological recovery (OR 2.65 [1.02, 6.88]) (Bernard et al., NEJM 346: 557-563, 2002).
 - Fever (Tmax) during first 48 hours is associated with a decreased chance of good neurological recovery (OR 2.26 [1.24, 4.12] for each 1°C over 37°C) (Zeiner et al., Arch Int Med. 161: 2007-2012; 2001).
-

INDICATIONS

- Cardiac arrest documented by paramedic, nurse or physician. Cardiac arrest is defined as absence of pulses requiring chest compressions.
 - Return of spontaneous circulation to maintain SBP>100 mmHg for at least 30 minutes
 - Core temperature >34°C at time of start
 - Begin within 6 hours of return of circulation.
 - Comatose at time of enrollment. Coma is defined as total GCS<10 or motor score<4 if intubated. Does not follow verbal commands.
-

RELATIVE CONTRAINDICATIONS:

- Uncontrolled bleeding, GI bleeding
- Thrombocytopenia or other coagulopathy.
- Advanced directives or DNR status
- Concerns for complications from cooling
- Cardiovascular instability – uncontrollable dysrhythmias, refractory hypotension

DETAILED TIME-LINE FOR INDUCED HYPOTHERMIA PROTOCOL

1. Initial Data Gathering

History – Exclusions, DNR, or underlying problems making effort futile
Confirm adequate monitoring
 ECG, SaO₂, CVP if potentially unstable, central temperature
Baseline Neurological Evaluation
 Exclude other causes of coma (glucose, mass lesions).
Discuss with proxy if available

2. Induction

Basic Maneuvers: (Passive Convective Cooling)
Expose patient, dampen skin, cooling fan
Cooling blanket set to 33°C
Cool Room
Ice packs in axilla / skin as needed.
Sedation as needed to prevent shivering
Chemical paralysis (vecuronium 0.05-0.1 mg/kg) as needed to prevent shivering

More Invasive Maneuvers: (Active Central Cooling)
NG lavage with ice cold fluid – repeated as needed
Cold IVF if tolerated – 2 liters

Prophylaxis:
APAP 1 gm PR or per NGT
Pepcid 20 mg IV

Other Considerations:
Establish Arterial Line and CVP during induction – do not delay induction
Check ABG (include lactate) at start and when reach 33°C
Anticipate diuresis and fall in serum K.

3. Starting labs

CBC/ platelets / PT / PTT
Lytes / BUN / Cr / Glucose / Ca / Mg / Phos
CPK-MB, Troponin
Lactate

4. At 6 hours

CPK-MB, Troponin
Glucose, K
ABG / Lactate

Prophylaxis:

APAP 500 mg PR/PO

5. At 12 hours

CPK-MB, Troponin
Glucose, K
ABG / Lactate

Prophylaxis:

APAP 500 mg PR/PO
Pepcid 20 mg IV

6. At 18 hours

CPK-MB, Troponin
Glucose, K
ABG / Lactate

Prophylaxis:

APAP 500 mg PR/PO

7. At 24 hours

CBC/ platelets / PT / PTT
BUN / Cr / Glucose/K
ABG / Lactate

Prophylaxis:

APAP 500 mg PR/PO

8. Begin rewarming – target over 6 hours or <math><1^{\circ}\text{C}</math> per hour

Basic Maneuvers:

Remove cooling blanket
Stop paralysis / sedation
APAP 500 mg PR/PO q 6 hrs for 24 hrs

Other Considerations:

Resume sedation if shivering occurs
Resume cooling blanket if temperature increases $>1^{\circ}\text{C}$ per hour.
Anticipate relative volume depletion – add fluids as indicated
Anticipate rise in serum K.

9. As patient reaches normal (36-37°C) temperature

Glucose, K
ABG / lactate
Repeat neurological evaluation
CXR – pneumonia / aspiration is common in this population

10. Daily

Neurological evaluation
Assess for infections / bleeding complications

APPENDIX

GENERAL GUIDELINES FOR POST-RESUSCITATION CARE BY SYSTEMS

Suggested instrumentation / monitoring:

ECG monitoring.
Arterial line for ABG and blood pressure monitoring.
(would femoral be better if cooling causes constriction ?)
Central venous pressure line.
Continuous SaO₂ by pulse-oximetry.
Capnography from ventilator circuit.
Temperature from central site (Bladder, CVP or PA catheter, esophageal, rectal)

Neurological:

Consider CT scan to exclude structural brain lesions.
Exclude hypoglycemia.
Monitor neurological status every 1 hour
Sedate as necessary to maintain comfort and prevent shivering
– fentanyl (2-4 mcg/kg) or lorazepam.(0.05 mg/kg)
- propofol (titrated)
Aggressively treat seizure activity – distinguish from myoclonus
Lorazepam followed by phenytoin followed by phenobarbital.

Neurological Assessment:

1. GCS (breakdown by side of body if different)
2. Oculocephalic / oculovestibular responses
3. Corneal reflexes
4. Myoclonus
5. Respiratory effort
6. Gag / cough

Cardiovascular:

Maintain SBP>100 mmHg or MAP >70 mmHg
– dopamine, norepinephrine, phenylephrine or epinephrine.
- if epinephrine required, consider rewarming and alternative causes.
If tolerated, target SBP 140-160 mm/hg, MAP 90-100 mmHg.
Avoid severe hypertension (SBP>200 mmHg or MAP >150 mmHg).
Workup for MI or Arrhythmia as clinically indicated.
Q6 hr enzymes, ECG
EP consult for malignant dysrhythmias

Pulmonary:

Eucapnia if following capnograph
Monitor ABG –
Aalpha-stat management – no temperature correction

Renal:

Monitor urine output (fluids to keep >0.5 ml/kg).
Daily BUN/Cr.

Gastrointestinal:

Promote early refeeding to minimize risk of ileus, translocation of bacteria.
Consider anti-H2 drugs for stress.
Guaiac stool to maintain vigilance for infarcted bowel.

Fluid / Electrolyte / Nutrition:

Support with maintenance fluids and resuscitative fluids.

D5NS at 1.0 cc/kg/hour as starting point for subject with normal renal function and no pulmonary edema.

Monitor serum glucose.

- Insulin to maintain euglycemia (serum glucose 100 mg/dl – 180 mg/dl).

Expect diuresis during cooling, and relative volume depletion afterwards.

- Bolus fluids as indicated.

Potassium shifts intracellularly during cooling, and reappears with warming.

- Diuresis adds to effect.

- Monitor frequently.

- Ca/Mg/PO4 will follow same pattern.

If unable to feed enterally within 36 hours, begin parenteral feeding.

Hematological:

Daily platelets, PT/PTT x 2 days to screen for hypothermia-induced coagulopathy. (Especially if patient is anticoagulated).

Circulatory arrest creates prothrombotic state.

Anticoagulation (heparin or LMWH) is probably indicated.

Infectious:

Aggressively avoid fever during first 48 hours

- acetaminophen

- active cooling

- proactive prevention of fever, rather than observation / reactive treatment

Sedation

Meperidine and Buspirone are noted for anti-shivering properties.

BASELINE CLINICAL DATA:

Time		Time			
_____	WBC	_____	Na		
	Hgb		K		
	HCT		Cl		
	Platelets		HCO3		
			BUN		
_____	PT / INR		Cr		
	PTT		Glucose		
_____	CK-MB				
	Troponin				
	Ventilator				
	Mode:	Rate:	TV:	PEEP:	FiO2:
_____	ABG: pH				
	pCO2				
	pO2				
	BE				
	Lactate				
_____	End-tidal CO2				

Neurological Assessment:

1. GCS:

E	V	M
---	---	---

2. Oculocephalic / oculovestibular responses

Absent	Slow only	Normal	Chemically Paralyzed
--------	-----------	--------	----------------------

3. Corneal reflexes

Present	Absent	Chemically Paralyzed
---------	--------	----------------------

4. Myoclonus

Present	Absent	Chemically Paralyzed
---------	--------	----------------------

5. Respiratory effort

Present	Absent	Chemically Paralyzed
---------	--------	----------------------

6. Gag / cough

Present	Absent	Chemically Paralyzed
---------	--------	----------------------

WHEN TEMPERATURE REACHES <34°C

Blood Pressure:

Time

Ventilator

Mode:

Rate:

TV:

PEEP:

FiO2:

_____ ABG: pH
pCO2
pO2
BE
Lactate
K

_____ End-tidal CO2

SIX (6) HOURS DATA:

Temperature:

Blood Pressure:

Time

_____ CK-MB
Troponin

_____ Glucose

Ventilator

Mode:

Rate:

TV:

PEEP:

FiO2:

_____ ABG: pH
pCO2
pO2
BE
Lactate
K

_____ End-tidal CO2

Neurological Assessment:

1. GCS:

E V M

2. Oculocephalic / oculovestibular responses

Absent Slow only Normal Chemically Paralyzed

3. Corneal reflexes

Present Absent Chemically Paralyzed

4. Myoclonus

Present Absent Chemically Paralyzed

5. Respiratory effort

Present Absent Chemically Paralyzed

6. Gag / cough

Present Absent Chemically Paralyzed

TWELVE (12) HOURS DATA:

Temperature:

Blood Pressure:

Time

_____ CK-MB
Troponin

_____ Glucose

Ventilator

Mode: Rate: TV: PEEP: FiO2:

_____ ABG: pH
 pCO2
 pO2
 BE
 Lactate
 K

_____ End-tidal CO2

Neurological Assessment:

1. GCS:

 E V M

2. Oculocephalic / oculovestibular responses

 Absent Slow only Normal Chemically Paralyzed

3. Corneal reflexes

 Present Absent Chemically Paralyzed

4. Myoclonus

 Present Absent Chemically Paralyzed

5. Respiratory effort

 Present Absent Chemically Paralyzed

6. Gag / cough

 Present Absent Chemically Paralyzed

EIGHTEEN (18) HOURS DATA:

Temperature:

Blood Pressure:

Time

_____ CK-MB
Troponin

_____ Glucose

Ventilator

Mode: Rate: TV: PEEP: FiO2:

_____ ABG: pH
 pCO2
 pO2
 BE
 Lactate
 K

_____ End-tidal CO2

Neurological Assessment:

1. GCS:

 E V M

2. Oculocephalic / oculovestibular responses

 Absent Slow only Normal Chemically Paralyzed

3. Corneal reflexes

 Present Absent Chemically Paralyzed

4. Myoclonus

 Present Absent Chemically Paralyzed

5. Respiratory effort

 Present Absent Chemically Paralyzed

6. Gag / cough

 Present Absent Chemically Paralyzed

TWENTY-FOUR (24) HOURS DATA:

Temperature:
Blood Pressure:

Time		Time
_____	WBC	_____
	Hgb	Na
	HCT	K
	Platelets	Cl
		HCO3
_____	PT / INR	BUN
	PTT	Cr
		Glucose

Ventilator
Mode: Rate: TV: PEEP: FiO2:

_____ ABG: pH
 pCO2
 pO2
 BE
 Lactate
 K

_____ End-tidal CO2

Neurological Assessment:

1. GCS:
 E V M
2. Oculocephalic / oculovestibular responses
 Absent Slow only Normal Chemically Paralyzed
3. Corneal reflexes
 Present Absent Chemically Paralyzed
4. Myoclonus
 Present Absent Chemically Paralyzed
5. Respiratory effort
 Present Absent Chemically Paralyzed
6. Gag / cough
 Present Absent Chemically Paralyzed

WHEN TEMPERATURE REACHES >36°C:

Blood Pressure:

Time

Ventilator

Mode:

Rate:

TV:

PEEP:

FiO2:

_____ ABG: pH
pCO2
pO2
BE
Lactate
K

_____ End-tidal CO2

Neurological Assessment:

1. GCS:

E V M

2. Oculocephalic / oculovestibular responses

Absent Slow only Normal Chemically Paralyzed

3. Corneal reflexes

Present Absent Chemically Paralyzed

4. Myoclonus

Present Absent Chemically Paralyzed

5. Respiratory effort

Present Absent Chemically Paralyzed

6. Gag / cough

Present Absent Chemically Paralyzed

POST-PROTOCOL DAILY ASSESSMENT:

Yes / No Evidence of infection

Yes / No Evidence of bleeding

Neurological Assessment:

1. GCS:

 E V M

2. Oculocephalic / oculovestibular responses

 Absent Slow only Normal Chemically Paralyzed

3. Corneal reflexes

 Present Absent Chemically Paralyzed

4. Myoclonus

 Present Absent Chemically Paralyzed

5. Respiratory effort

 Present Absent Chemically Paralyzed

6. Gag / cough

 Present Absent Chemically Paralyzed