

NURSING CLINICAL STANDARD

TARGETED TEMPERATURE MANAGEMENT - ED/ ICU / CATH LAB

- PURPOSE:** To outline the management of patients receiving Targeted Temperature Management (TTM) by maintaining patient's body temperature at a Targeted Normothermia (36°C to 37.5 °C) or Targeted Hypothermia between 32° C and 35.9 °C for a specific duration of time for the purpose of preserving neurological function post cardiac arrest in the ED, ICU or cath lab. This includes non-traumatic out-of-hospital cardiac arrest (OHCA) transported to ED.
- INDICATIONS:** Implement this standard immediately after cardiac arrest as ordered.
- SUPPORTIVE DATA:** Approximately 5-30% of patients resuscitated from cardiac arrest survive to hospital discharge, but the majority of these patients have suffered some degree of ischemic brain injury. The control of core body temperature by TTM as recent research suggests has been an important neuroprotective strategy in postresuscitation care.
- TTM may be ordered by an ED provider, cardiologist, neurologist or intensivist. Targeted Hypothermia is maintained for at least 24 hours of temperature being within goal range or as ordered.
- If ordered, Rewarming phase occurs at no more than 0.25 degree C every hour (1 degree C every 4 hours) or as ordered.
- During Targeted Hypothermia, the patient is at risk for:
- Hypotension due to diuresis and decreased cardiac output
 - Arrhythmias (Bradycardia, prolonged QT interval, torsades de pointes)
 - Hypokalemia due to shifting of potassium from vasculature into the cells
 - Coagulopathy
 - Infection
 - Hyperglycemia
- During rewarming (if ordered), the patient is at risk for:
- Hypotension due to vasodilation
 - Hyperkalemia as potassium shifts back into the vasculature; therefore hypokalemia during cooling must be treated cautiously
- Shivering/hyperthermia must be prevented/ treated, as it results in warming and increased oxygen consumption.
- During Targeted Normothermia, core body temperature goal is aimed between 36°C to 37.5 °C, with fever prevention in the further course of treatment.
- The following are recommended TTM inclusion and exclusion criteria:
- All comatose patients greater than 14 years of age with return of spontaneous circulation (ROSC) after cardiac arrest should receive TTM. TTM should be considered for adolescents, 14 years of age or less with sudden ventricular fibrillation or pulseless ventricular tachycardia with ROSC. Current guidelines recommend TTM for both shockable and non-shockable rhythm as well as for in-hospital cardiac arrest. However, based on current randomized controlled trials and recent American Heart Association recommendations, providers may opt to exclude from TTM the following patients: a) post cardiac arrest with rhythm other than pulseless ventricular tachycardia or ventricular fibrillation (i.e. pulseless electrical activity, asystole), b) in hospital cardiac arrest.
- There are no absolute contraindications for TTM, however it is reasonable to avoid temperatures below 36 degrees Celsius in the following scenarios:

- **Post cardiac arrest with rhythm other than pulseless ventricular tachycardia/ventricular fibrillation (pVT/VF)**
- Pregnancy
- Awake / responsive to verbal commands
- Known intrinsic bleeding diathesis (e.g., hemophilia, Von Willebrand)
- Acute intracranial bleeding
- Suspected or confirmed acute stroke
- Known wishes for limitations in resuscitation and/or a Do Not Resuscitate order
- Known comorbid disease making 180 days survival unlikely
- Preceding poor neurological function
- Delays longer than 6 hours from ROSC to cooling
- Systolic blood pressure less than 80 mm Hg despite fluid resuscitation, vasopressor(s) and possibly including inotropic medication and/or intra-aortic balloon pump
- Severe bradycardia
- Temperature on admission less than 30 degrees Celsius
- Chronic renal disease
- Major head trauma
- Septic Shock

ASSESSMENT:

1. Assess the following prior to inducing Targeted Hypothermia:
 - Vitals signs
 - Rectal, bladder or pulmonary artery catheter temperature (It is recommended to monitor two temperature sources)
Note: Rectal or bladder temperature must be used with the cooling/warming device approved for Targeted Hypothermia.
 - Level of consciousness
 - Pupil response
 - Richmond Agitation Sedation Scale (RASS) score
2. Assess the following a minimum of:
 - Every 15 minutes during active cooling stage (until goal temperature is reached) and during rewarming phase:
 - Vitals signs
 - Temperature (rectal, bladder, or pulmonary artery catheter)
 - Level of consciousness
 - Pupil response
 - RASS score
 - Presence/absence of shivering (Bedside Shivering Assessment Scale (BSAS) score)
 - Presence/absence of cardiac dysrhythmias
3. Assess the following a minimum of every hour while hypothermic:
 - Vitals signs
 - Temperature (rectal, bladder or pulmonary artery catheter)
 - Level of consciousness
 - Pupil response
 - RASS score
 - Presence/absence of shivering
 - Presence/absence of cardiac dysrhythmias
4. Assess skin (including areas in contact with cooling/warming measures) a minimum of every 2 hours
5. Assess labs as drawn (especially electrolyte levels)
6. Implement provider's orders (per order set):
 - Obtain 12 lead ECG
 - Chest X ray
 - Send lab tests: troponin, arterial blood gas (pH, PaO₂) and lactate
 - Obtain urine pregnancy test in women less than 50 years of age
 - Ensure IV access is patent with two peripheral IV 18 gauge (if patient does not have central line)
 - Place Nasogastric tube/Orogastric tube to low wall suction (unless contraindicated)

PRE-HYPOTHERMIA CARE:

- Place indwelling bladder catheter to gravity
7. Collaborate with Respiratory Care and provider to ensure pCO₂ of approximately 40 mmHg and O₂ saturation greater than 94%.
 8. Ensure rectal, bladder temperature probe, or pulmonary artery thermistor are in place
 9. Mark distal pulses

COOLING &
MAINTENANCE
PHASE:

10. Attempt to achieve core body temperature goal as ordered within 2-6 hours of initiating TTM (as ordered). Continue TTM for at least 24 hours of temperature being within goal range.
11. Cool patient, using the following methods as ordered:
 - Cooling machine approved for TTM
 - Ensure temperature probe is attached to patient and machine (must be rectal or bladder temperature probe)
 - Preset machine to ordered goal temperature, examples:
 - At 33°C or
 - At 34°C or
 - At 35°C – 35.9°C or
 - At 36°C or
 - At 37°C or
 - At 37.5 °C

Note: May set machine to lower temperature to initially cool machine, but machine temperature must be set to goal temperature prior to attaching it to patient's temperature probe.

 - Apply cooling vest/ suit/mat to patient
 - Attach patient's temperature probe to machine
 - Apply ice packs to groin, axillae, and sides of neck and head
 - Infuse 2 liters chilled saline IV over 1-2 hours x 1 (Pediatric: 30 mL/kg, Maximum 2 liters)
 - Check with provider regarding discontinuation of ventilator heater
 - Ice packs
12. Notify the ordering provider if goal temperature is not reached in 2 hours.
13. Discontinue cooling measures if temperature falls below goal temperature ordered and resume cooling when temperature returns to goal temperature ordered
14. Initiate sedation/analgesia (e.g. midazolam [*Versed*] / fentanyl), as ordered.
15. Initiate paralytic agent (vecuronium) as ordered. Refer to Neuromuscular Blocking Agent Standard.
16. Send labs and obtain 12 lead ECG as ordered.

SHIVERING:
REWARMING:

17. Administer medication as ordered
18. Begin rewarming if ordered by removing cooling measure(s) or through rewarming function of the device.
19. Rewarm **slowly** at approximately 0.25° C every hour (1° C every 4 hours) or as ordered until temperature reaches 99.5 degrees F (37.5 ° C). Do not reinstitute cooling measures if patient warms more quickly. If patient warms more quickly, do not re-cool.
20. Discontinue paralytics (as ordered) when temperature reaches 36.5° C.
21. Keep patient's skin and bedding dry and place standard bedding over patient and allow for passive rewarming.

PATIENT/CAREGIVER
TEACHING:

22. Teach the family the purpose of TTM.

REPORTABLE
CONDITIONS:

23. Notify the provider for the following:
 - Need for additional sedation
 - Vital signs outside of predetermined parameters
 - Pupil changes
 - Shivering unrelieved by medications

- Worsening LOC
- Development of dysrhythmia
- Goal temperature is not reached within the ordered time frame
- Abnormal lab values.

ADDITIONAL STANDARDS:

24. Refer to the following standards:
- Intravenous Therapy
 - Mechanical Ventilation
 - Sedation and Analgesia (Intravenous)- ICU
 - Artificial Airway
 - Neuromuscular Blocking Agent Protocol -ICU

DOCUMENTATION:

25. Document in accordance with documentation standards.
26. Document the following on the - TTM Navigator Band as updated
- Date/time Targeted Normothermia or Targeted Hypothermia initiated
 - Date/time targeted temperature reached
 - Date/time cooling phase ended
 - Date/time rewarming phase started and ended (if ordered)
 - Method of rewarming/ use of blankets and/or warming device
 - Required monitoring/assessments during cooling and rewarming
27. Document skin assessment on Systems Assessment Navigator Band
28. Document GCS score and CPC scale upon hospital discharge.

Cerebral Performance Categories Scale
CPC Scale

<small>Note: If patient is anesthetized, paralyzed, or intubated, use "as is" clinical condition to calculate scores.</small>
CPC 1. Good cerebral performance: conscious, alert, able to work, might have mild neurologic or psychologic deficit.
CPC 2. Moderate cerebral disability: conscious, sufficient cerebral function for independent activities of daily life. Able to work in sheltered environment.
CPC 3. Severe cerebral disability: conscious, dependent on others for daily support because of impaired brain function. Ranges from ambulatory state to severe dementia or paralysis.
CPC 4. Coma or vegetative state: any degree of coma without the presence of all brain death criteria. Unawareness, even if appears awake (vegetative state) without interaction with environment; may have spontaneous eye opening and sleep/awake cycles. Cerebral unresponsiveness.
CPC 5. Brain death: apnea, areflexia, EEG silence, etc.

Safar P. Resuscitation after Brain Ischemia, in Grenvik A and Safar P Eds: Brain Failure and Resuscitation, Churchill Livingstone, New York, 1981; 155-184.

TABLE 38-2		
Glasgow Coma Scale		
BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
Best motor response	No response	1
	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
Total score:	Abnormal extension (decerebrate)	2
	<i>Best response</i>	15
	<i>Comatose client</i>	8 or less
	<i>Totally unresponsive</i>	3

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The Bedside Shivering Assessment Scale (BSAS)

Score	Definition
0	None: no shivering noted on palpation of the masseter, neck or chest wall
1	Mild: shivering localized to the neck and/or thorax only
2	Moderate: Shivering involves gross movement of the upper extremities (in addition to neck and thorax)
3	Severe: shivering involves gross movement of the trunk and upper and lower extremities

Richmond Agitation Sedation Scale (RASS) *

Score	Term	Description	
+4	Combative	Overtly combative, violent, immediate danger to staff	
+3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive	
+2	Agitated	Frequent non-purposeful movement, fights ventilator	
+1	Restless	Anxious but movements not aggressive vigorous	
0	Alert and calm		
-1	Drowsy	Not fully alert, but has sustained awakening (eye-opening/eye contact) to voice (≥ 10 seconds)	} Verbal Stimulation
-2	Light sedation	Briefly awakens with eye contact to voice (< 10 seconds)	
-3	Moderate sedation	Movement or eye opening to voice (but no eye contact)	} Physical Stimulation
-4	Deep sedation	No response to voice, but movement or eye opening to physical stimulation	
-5	Unarousable	No response to voice or physical stimulation	

Procedure for RASS Assessment

1. Observe patient
 - a. Patient is alert, restless, or agitated. (score 0 to +4)
2. If not alert, state patient's name and say to open eyes and look at speaker.
 - b. Patient awakens with sustained eye opening and eye contact. (score -1)
 - c. Patient awakens with eye opening and eye contact, but not sustained. (score -2)
 - d. Patient has any movement in response to voice but no eye contact. (score -3)
3. When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.
 - e. Patient has any movement to physical stimulation. (score -4)
 - f. Patient has no response to any stimulation. (score -5)

* Sessler CN, Gosnell M, Grap MJ, Brophy GT, O'Neal PV, Keane KA et al. The Richmond Agitation-Sedation Scale: validity and reliability in adult intensive care patients. *Am J Respir Crit Care Med* 2002; 166:1338-1344.

* Ely EW, Truman B, Shintani A, Thomson JWW, Wheeler AP, Gordon S et al. Monitoring sedation status over time in ICU patients: the reliability and validity of the Richmond Agitation Sedation Scale (RASS). *JAMA* 2003; 289:2983-2991.

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Consults:

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