

Hyperthermia and Heat Exposure

Aliases

Hyperthermia, heat cramps, heat exhaustion, heat syncope, heat edema, heat stroke

Definitions

1. *Heat cramps* are minor muscle cramps usually in the legs and abdominal wall. Patient temperature is normal.
2. *Heat exhaustion* has both salt and water depletion usually of a gradual onset. As it progresses tachycardia, hypotension, elevated temperature, and very painful cramps occur. Symptoms of headache, nausea and vomiting occur. Heat exhaustion can progress to heat stroke.
3. *Heat stroke* occurs when the cooling mechanism of the body (sweating) ceases due to temperature overload and/or electrolyte imbalances. Patient temperature is usually **greater than** 104°F. When no thermometer is available, it is distinguished from heat exhaustion by altered level of consciousness.
4. *Heat syncope* is a transient loss of consciousness with spontaneous return to normal mentation attributable to heat exposure.
5. *Heat edema* is dependent extremity swelling caused by interstitial fluid pooling.

Patient Care Goals

1. Administer cooling and rehydration.
2. Mitigate high risk for decompensation.
3. Mitigate high risk for agitation and uncooperative behavior.

Patient Presentation

Inclusion Criteria

1. Heat cramps
2. Heat exhaustion
3. Heat stroke
4. Heat syncope
5. Heat edema
6. Stimulant drug abuse
7. Excited delirium [see Agitated or Violent Patient/Behavioral Emergency guideline]

Exclusion Criteria

1. Fever from infectious or inflammatory conditions
2. Malignant hyperthermia
3. Serotonin syndrome
4. Neuroleptic malignant syndrome

Patient Management

Assessment

1. Patient Assessment:
 - a. Age
 - b. Oral intake
 - c. Medications
 - d. Alcohol
 - e. Illicit drugs
 - f. Overdose
 - g. Withdrawal risk
2. Environmental Assessment:
 - a. Ambient temperature and humidity

- b. Exertion level
 - c. Length of time at risk
 - d. Attire (clothing worn)
 - e. Confined space
 - i. **Pediatric Considerations:** Children left in cars who show signs of altered mental status and elevated body temperature should be presumed to have hyperthermia.
3. Associated Symptoms:
- a. Cramps
 - b. Headache
 - c. Orthostatic symptoms
 - d. Nausea
 - e. Weakness
 - f. Mental status changes, including
 - i. Confusion.
 - ii. Coma.
 - iii. Seizures.
 - iv. Psychosis.
4. Vital signs:
- a. Temperature: Ideally rectal.
 - b. Skin:
 - i. Flushed and hot
 - ii. Dry or sweaty
 - iii. Signs of first or second degree burns from sun exposure
 - c. Other signs of poor perfusion or shock

Treatment and Interventions

1. Move victim to a cool area and shield from the sun or any external heat source.
2. Remove as much clothing as is practical and loosen any restrictive garments.
3. If alert and oriented, give small sips of cool liquids.
4. If altered mental status, check blood glucose level
5. Manage airway as indicated.
6. Place on ECG cardiac monitor and record ongoing vital signs and level of consciousness.
7. If temperature is greater than 104°F (40°C) or if altered mental status is present, begin active cooling:
 - a. Immerse the patient in an ice bath if available
 - Preferred cooling method if available.
 - b. Mist the exposed skin continually with tepid water while fanning the victim (most effective).
 - c. Note that using truncal ice packs are acceptable, but are less effective than evaporation.
 - d. DO NOT apply wet clothes or wet clothing, as they may trap heat and prevent evaporative cooling.
 - e. If shivering occurs during cooling, administer **Midazolam** (preferred benzodiazepine)[**PARA**]
 - Adult: 2.5-5mg IV/IM/IO/IN repeat q 5-10 minutes
 - Pediatric: 0.1 mg/kg max 2.5mg IM/IN/IV/IO; repeat q 5-10 minutes
8. Continue cooling efforts until the patient's temperature is less than 102.2°F (39°C) and the patient demonstrates improvement in mental status.
 - a. **Cooling is first priority**
 - b. **If immersive ice bath is present on scene its use justifies extended scene time as long as patient can be monitored, altered mental status does not present immediate airway concern and no other life threats are present**
 - c. If the patient is at a location with Athletic Trainer and defined exertional heat stroke cooling protocol, in general, defer to the Athletic Trainer to lead the cooling efforts per their protocol.
 - If concerns about continuing cooling versus transport for co-present conditions: CONTACT MEDICAL CONTROL to discuss treatment recommendations

9. Consider isotonic IV/IO fluid bolus 20 ml/kg [*AEMT*]
10. Monitor for arrhythmia and cardiovascular collapse [see Cardiovascular section guidelines].
11. Treat seizures per the Seizures guideline.
12. Transport all patients suffering from life threatening heat illness (including heat stroke) to the hospital.

Patient Safety Considerations

Consider use of physical securing devices [see Agitated or Violent Patient/Behavioral Emergency guideline] to protect vascular access sites.

Notes and Educational Pearls

Key Considerations

- Patients at risk for heat emergencies include neonates, infants, geriatric patients, and patients with mental illness.
- Contributory risk factors may come from:
 - Prescription and over-the-counter herbal supplements.
 - Cold medications.
 - Heart medications.
 - Diuretics.
 - Psychiatric medications.
 - Drug abuse.
 - Accidental or intentional drug overdose.
- Heat exposure can occur either due to increased environmental temperatures or prolonged exercise or a combination of both.
Note: Environments with temperature **greater than** 90°F and humidity **greater than** 60% present the most risk.
- Heat stroke is associated with cardiac arrhythmias independent of drug ingestion or overdose. Heat stroke has also been associated with cerebral edema.
- Do not forget to look for other causes of altered mental status such as low blood glucose level, or, in the proper circumstances (e.g. endurance exercise events), consider exercise associated hyponatremia (EAH), especially in the patient with altered mental status, normal blood glucose, and normal temperature.
- *Controversy:*
 - Shivering may occur while treating heat stroke.
 - It is uncertain how harmful shivering is to heat stroke patients.
- Cooling should be continued until the above temperature and mental status goals are met.
- Treat shivering as described above in 7a, under Treatment and Interventions.
- Hyperthermia that is **not** the result of environmental factors has a differential that includes the following:
 - Fever and delirium
 - Hyperthyroid storm
 - Delirium tremens (DTs)
 - CNS lesion or tumor
 - Adverse drug event: neuroleptic malignant syndrome, malignant hyperthermia
 - Mental status changes without hyperthermia in the correct circumstances could be exercise associated hyponatremia

Pertinent Assessment Findings

1. Warning signs: fever, altered mental status
2. Blood glucose level for AMS

Quality Improvement

Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914027—Environmental - Heat Exposure/Heat Exhaustion
- 9914029—Environmental - Heat Stroke /Heat Exposure

Key Documentation Elements

- Patient assessment includes all types of medication or drug use and detailed past medical history
- Environmental assessment performed
- Cooling interventions considered and implemented
- Decision-making regarding securing devices
- Decision-making regarding monitoring ABCs

Performance Measures

- Blood glucose level obtained
- Fluids given for hypotension
- Attempts to reduce core temperature
- All decompensations during EMS care reviewed
- **EMS Compass Measures** (for additional information, see www.emscompass.org)
 - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia
 - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms

References

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