

I02: Hyperthermia

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Introduction

Hyperthermia is a life-threatening emergency that requires immediate and aggressive treatment to lower body temperature. Untreated, heat stroke leads to multiorgan failure and death, and the single greatest contributor to patient morbidity and mortality is the duration of the elevated core body temperature.

First responders, emergency medical responders, and paramedics can expect an increase in frequency and intensity of extreme heat events as climate destruction worsens these phenomena.

This guideline provides clinicians with the knowledge necessary to quickly recognize environmental heat injury, identify environmental and population-based risk factors, and to perform critical rapid cooling techniques.

Essentials

- Rapid recognition of environmental factors and patient risk factors for heat illness is key to management. Be aware of the diversity of the clinical manifestations of heat illness.
- Cooling should be initiated on scene wherever possible, and continued throughout patient transport.
- Recognize and treat concurrent dehydration if present.

Warning:

Hyperthermia as a result of increased environmental temperature is not equivalent to hyperthermia produced because of fever or medication use. Use clinical observation to differentiate the primary cause of heat, and treat environmental heat exhaustion/heat stroke according to this protocol.

- **DO NOT treat environmental heat exhaustion/heat stroke with anti-pyretics.** There is no role for antipyretic agents such as [acetaminophen](#) or [aspirin](#) in the management of heat stroke, since the underlying mechanism does not involve a change in the hypothalamic set-point and these medications may worsen complications such as hepatic injury or disseminated intravascular coagulation (DIC).
- **IV Fluid should not be routinely administered** to patients suffering from heat stress unless signs of dehydration, hypotension, or shock are present, in which case it should be started after initiating full-body cooling and given with caution with the goal of correcting hypoperfusion. Ensure that saline solution is NOT WARM to the touch.
- **Oral hydration is not an effective cooling technique.** Dehydration can be a concomitant pathology that demands attention, as mentioned above. Patients who are dehydrated and able to ingest liquids should self-administer oral rehydration solution (electrolytes) if available without delaying transport.

Additional Treatment Information

- Induced hypothermia is an unwarranted concern for paramedic care of heat-injured patients.
- Consultation with ClinCall may help to guide care planning in call cases of hyperthermia. Pre-arrival notification to receiving facilities can improve transition of care and initiation of core temperature monitoring and management.
- The basic treatments for heat emergencies are the same across all license levels and vary only in the case of critically ill patients suspected of heat stroke.
- The management of classic heat stroke consists of ensuring adequate airway protection, breathing, circulation, **rapid active cooling**, and treatment of complications.
- In-hospital treatment consists of full-body ice-water immersion in a dedicated tank or in body bags with core temperature monitoring and management of end-organ complications. Full-body cooling is continued until core temperature drops to 38.3–39°C; manifestations of organ damage are managed specifically and separately (e.g. coma, adult respiratory distress syndrome, disseminated intravascular coagulation, hepatic failure, renal failure, rhabdomyolysis).
- Be sure to differentiate shaking and tremors from seizures. Manage seizures in accordance with [F02: Seizures](#).

Referral Information

[ASTaR for heat emergencies](#) - includes alternative destination and access to cooling centres and advice for home

General Information

Heat stroke has a remarkably high mortality rate, between 21-63% in heat stroke patients who arrive to hospital. The first cells affected by core body temperature $\geq 40^{\circ}\text{C}$ are: neurons, hepatocytes (liver cells) and vascular endothelial cells (the inner lining of all blood vessels), yet all body organs will be injured by hyperthermia.

It can be hard to fully recognize the threat of heat stroke because the damage is at a cellular/tissue level. It is therefore critical that the paramedics identify abnormalities in any body system during their initial and ongoing assessments, and record and report their findings during patient handover in hospital.

The importance of initiating cooling on-scene cannot be overstated. All heat illness patients should receive immediate cooling on-scene and during transport, regardless of proximity of higher level of care or predicted time of conveyance.

Environmental risk factors for development of heat illness include:

- Hot weather, with or without high environmental humidity
- Enclosed spaces with poor ventilation
- Outdoor spaces with no shade
- Lack of access to water

Patient-specific risk factors for the development of heat illness include:

- Elderly individuals: the body has a lower water content in older age, which predisposes elders to severe heat injury compared to younger people
- Mental illness, specifically schizophrenia, can predispose individuals to severe heat injury.

Caution: These two groups are considered the highest-risk cohorts for the development of lethal heat injuries. Exercise extreme care while developing patient care plans, consult with CliniCall as required, and convey patients to appropriate destinations if safety cannot be assured.

- Obesity: adipose tissue insulates the body and retains heat; it may also generate additional heat
- Physical exertion
- Concomitant or chronic illnesses
- Use of alcohol, drugs, or other medications (including anticholinergics, antidopaminergics, antihistamines, antipsychotics, beta- and calcium channel blockers, diuretics, antidepressants, and lithium).
- Pregnancy
- Socioeconomic and/or Occupational vulnerability

Signs and Symptoms of Heat illness and Injury:

The formal definition of heat stroke – either exertional or classic heat illness from high environmental temperatures, with or without physical activity – is a core temperature above 40°C with central nervous system dysfunction. Measurement of core temperature is only authorized for CCP providers, meaning that other providers must use clinical findings as part of their assessment. History is critically important. Use observations of the environment as well as patient signs and symptoms to guide treatment planning.

Differentiating between heat exhaustion and heat stroke can be difficult. The key element is the degree of central nervous system impairment. The treatment for both is the same.

Heat exhaustion and heat stroke can mimic or present concurrently with many other illnesses. Paramedics must consider the possibility of sepsis, ischemic strokes, hypoglycemia, toxic ingestion, or drug misuse.

Prevention is critical and can save lives. Patients with stable vital signs, fully intact level of consciousness and orientation and no signs of heat exhaustion or heat stroke can be moved to a cool environment and encouraged to rest and stay hydrated. When providing on-scene guidance and support to patients, remember that fans alone are insufficient for cooling purposes, and may exacerbate heat exposure due to convective air movement in areas where ambient temperatures exceed 35°C .

"Heat cramps" are localized and painful muscle spasms most often due to electrolyte loss from strenuous activity in a hot environment, cramp onset is usually at rest immediately after activity. Heat cramp patients have no evidence of dehydration. Paramedics, emergency medical responders, and first responders can encourage heat cramp patients to self-administer oral electrolyte drinks.

Heat stroke or heat exhaustion should be assumed in any patient exposed to extreme environmental heat with any of the following signs and symptoms:

- Extreme weakness
- Flushed, hot skin; pale, cold skin; with or without sweating
- Shivering
- Pallor
- "Prickly heat" sensation
- Dehydration
- Fatigue
- Headache
- Light-headedness
- Altered mental status
- Confusion
- Behavioural changes
- Imbalance (ataxia)
- Unresponsive
- Seizure
- Tachycardia
- Hypotension
- Dysrhythmia
- Tachypnea or bradypnea
- Low SpO2
- Abdominal cramps, nausea, vomiting, or diarrhea
- Persistent muscle cramps

Interventions

First Responder

- Recognize early signs of heat injury and treat accordingly:
- Heat cramps: rest in a cool place and recommend oral electrolytes

Open any ventilation sources if indoors / move patient to shade if outdoors.

If any signs/symptoms of heat exhaustion or heat stroke are present, begin immediate cooling:

- Remove all clothing on patient
- To maximal extent possible, based on patient presentation (primarily level of consciousness, patient capacity to follow instructions, absence of other priority intervention needs) and available resources, begin cooling with coldest water possible. The goal is to promote rapid, continuous heat loss. Options may include:
 - If available, begin convective cooling with air conditioning set to maximum cold in conjunction with any other interventions
 - Application of cold, wet towels to head, torso, and thighs to promote evaporative cooling
 - Full-body immersion in bath tub with cold water and ice
 - High-flow cold water in shower while seated in chair
 - Immersion of feet and legs in a bucket or basin of ice water
 - **Caution!** Do not attempt immersion or shower-based cooling in patients who are not able to ambulate safely. Apply principles of safe patient movement as described in [PR01: Ambulating Patients](#) prior to selecting a cooling strategy.

- Assess patient continually during cooling.
- Notify follow-on responders of clinical findings and request response time updates

Emergency Medical Responder – All FR interventions, plus:

- Continue cooling efforts for a minimum of 10 minutes prior to beginning conveyance to hospital.
- Assess and record vital signs every 10 minutes. Initial vital signs must include blood glucose measurement.
- The most aggressive cooling method available should be applied during transport and continued until the recommended treatment endpoints are reached.
- Continue evaporative cooling with soaked towels (head, torso and thighs).
- Begin or continue convective cooling with AC of ambulance on maximum cold.

Primary Care Paramedic – All FR and EMR interventions, plus:

After immediate rapid cooling is underway:

- Consider need for fluid replacement in patients with signs and symptoms of dehydration. **Do not administer intravenous fluids that are warm to the touch.**
 - [→ D03: Vascular Access and Fluid Administration](#)
 - [CliniCall Consultation recommended](#) to discuss fluid resuscitation and care planning options.
- Record history: exposure time, details of environment, all symptoms patient is able to communicate. Ask about headache, visual disturbances, palpitations, shortness of breath, nausea, vomiting, urine output.
- Continual serial assessments of neurological status, blood pressure and pulse
- Assess capillary blood glucose; correct hypoglycemia as required
 - [→ E01: Diabetic Emergencies](#)
- For obtunded, unresponsive patients, consider supraglottic airway
 - [→ PR08: Supraglottic Airways](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Obtain and interpret 12 lead ECG when possible.
 - Manage dysrhythmias as required. Note that dysrhythmias associated with heatstroke do not usually resolve until patient is normothermic. VF/VT can be defibrillated, but cooling remains the definitive treatment
- Consider anticonvulsant
 - [→ F02: Seizures](#)
- Consider endotracheal intubation in unresponsive patients
 - [→ PR18: Anesthesia Induction](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider rectal or esophageal core temperature read within 2 minutes of patient contact and ongoing throughout cooling.
- Stop cooling when body temperature reaches 38-39°C
- Monitor for and correct metabolic derangements (hypernatremia, hyperkalemia, acidosis)

Evidence Based Practice

Hyperthermia

Supportive

- [External Cooling](#)

Neutral

- [IV Fluid as a cooling agent](#)
- [Temperature Monitoring](#)

Against

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Practice Updates

- 2022-09-22: Typographical corrections.
- 2022-06-04: Revised and re-published. The previous version archived, no longer publicly available.
- 2022-07-29 - Addition of Heat Emergency ASTaR Pathway in the referral section.

