

Beat the Heat: An Approach for Suspected Heat-related Illnesses

By Kurt Eifling, MD

Summer is here, and everyone knows what that means: swimming, outdoor concerts, barbecues, and good old heat stroke. All of us working in pre-hospital and emergency care settings expect to see exposure casualties as the weather warms, so what better time to review the science and art of caring for a sagging summertime patient beaten by the heat?

Definitions

Heat illness is divided into benign and life-threatening categories. The benign conditions caused by activity in the heat include heat cramps, heat syncope, and heat exhaustion—these typically occur at core temperatures below 104 degrees F. The life-threatening version of heat illness is heat stroke, defined as altered mental status or other organ failure due to elevated core temperature without other apparent cause—usually this happens at temperatures above 104 degrees F. Local protocols will define the key temperature that differentiates heat stroke from benign heat illness; refer to local protocols and know this crucial figure prior to your summer season.

While these forms of hyperthermia (elevated core temperature) are distinct from fever, which occurs when the hypothalamus sets a higher body temperature in response to infection or inflammation, it's worth noting that the initial treatment in the pre-hospital setting is rather similar. The exception is anti-pyretic administration, which is not recommended in heat illness.

Diagnosis

For first responders, emergency medical technicians, and paramedics, the diagnosis of any heat illness starts with an appropriate level of suspicion. Remember that children, the elderly, and those with chronic medical conditions are at higher risk of developing heat injury whether at rest or exerting themselves in a hot environment. Conversely, a healthy person engaged in seemingly low-risk activity such as a triathlon swim in cool, 80-degree water could overheat if wearing a neoprene wetsuit too thick for the conditions.

Anyone exposed to summer weather or engaged in vigorous activity should be considered at-risk. Cramps, fatigue, nausea, and malaise are the hallmarks of benign heat illness. Altered mental status heralds the onset of heat stroke, and may be the first warning sign of impending multisystem organ failure. Dry or hot skin, diminished urine output, and dry mucous membranes may be additional clues. Diagnose heat illness by maintaining **a high index of suspicion in risky populations**, and by checking a temperature on all patients whenever possible.

Mimics and pitfalls: salt, sugar, and heat

Like any summer barbecue, the evaluation of summer exposures revolves around salt, sugar, and heat. When approaching patients at risk for heat illness, remember to watch out for changes in blood glucose and sodium that may complicate or mimic heat illness. Hypoglycemia is a mimic that causes sweating, altered mental status, weakness, and fatigue in athletes and the chronically ill. A point-of-care glucose check or a trial of buccal dextrose therapy can help make this diagnosis.

Hyponatremia is a key consideration in patients who have been sweating avidly in hot conditions or drinking large amounts of water without salts, and especially in those whose bodies are unaccustomed to hot temperatures. Symptoms of hyponatremia include nausea, fatigue, mood swings, altered mental status, and in extreme cases, seizures. For symptomatic patients in the heat, hyponatremia should climb your differential diagnosis list if you find a normal temperature and normal glucose.

Paradigm of treatment for heat illness

As the core temperature rises, it eventually causes alteration in mental status (AMS). In the emergency department setting, 104 degrees F is often used as the cutoff temperature. That is to say, patients with AMS or other symptoms and a core temperature less than 104 *may* have heat-related problems, but heat stroke is unlikely the cause of AMS or organ failure. For patients with a core temperature over 104 degrees F in the right clinical context, temperature must be considered the primary problem and treated as a priority of therapy.

For pre-hospital protocols, lower temperature thresholds often will be used to avoid under-triaging patients suffering potential heat stroke, and to compensate for oral temperatures that may be lower

than core temperatures. The initial diagnosis is heat stroke for patients with altered mental status and a temperature over the locally established threshold temperature. Patients with heat stroke are more likely to die the higher their temperature is, and the longer it remains elevated. **The treatment for heat stroke is to drop the core temperature to a safe level, between 100 and 102F, as quickly as possible. Then cease active cooling.**

Preventing heat illness

Many summer events and gatherings will have first responders, emergency medical technicians, and paramedics on-hand to evaluate and treat patients affected by the weather and activities. When preparing to staff risky events, pre-hospital care providers should plan to minimize risk and maximize treatment options.

- **Advise the planners.** Counsel event planners to minimize heat risk by holding events in cooler times of day or by modifying activities if the weather is excessively hot or humid.
- **Prepare your position.** Ensure that aid stations have access to good passive cooling capabilities such as shade, air conditioning, air circulation, and privacy for removing clothing. If there is a cool body of water nearby appropriate for immersion therapy, discuss a plan for whether to use that water for cooling a heat stroke patient.
- **Prepare your materials.** Ideally, pre-hospital personnel will have access to high-temperature thermometers, point-of-care glucose testing equipment, chilled intravenous fluids, and evaporative cooling equipment such as fans and spray bottles of water. Larger events, like marathons, may have point-of-care testing for serum sodium levels. Ensure access to cool drinks, sugary foods, and salty foods.
- **Advise the masses.** People who are exposed to high-risk activities and environments should “drink to thirst” instead of drinking to meet a set quota of volume. They should take breaks when tired, and protect themselves from the sun.

The science behind the treatment

What is the best way to cool an overheated patient? Choose your cooling method based on the severity of the patient’s condition and then by the assets available. First, decide whether passive or active cooling is most appropriate. Passive cooling techniques simply maximize the body’s innate ability to give up heat. Interventions include loosening clothing, finding shade or a cooler environment, and resting. Passive cooling is appropriate for patients with heat exhaustion or heat cramps, and should be used as a comfort measure while evaluating patients for sugar and salt problems. Active cooling measures are maneuvers that actively remove heat from a patient’s body. Interventions include cold-water immersion, chilled intravenous fluid infusion, evaporative cooling, application of ice packs, and internal irrigation of the bladder or peritoneal space with chilled fluids. Active measures should be added for patients who are suspected to have heat stroke.

Scientific studies of various cooling methods show that cold water immersion is the fastest way to drop a patient’s core temperature, however this finding is of little use to the pre-hospital provider who does not carry around an ice-water tank. Instead, evaporative cooling is typically the most practical intervention, best achieved by misting water over the patient’s skin and providing a breeze to increase evaporation of the water, maximizing both conductive and convective heat loss. Moistening sheets or clothing with water is not as effective as wetting bare skin. Chilled normal saline is an adjunct to evaporative cooling. Avoid Ringer’s Lactate fluids and colloid fluids in heat illness patients due to these patients’ risk for liver dysfunction.

Medications have also been studied for overheated patients. In a patient without fever from infection or inflammation, acetaminophen and ibuprofen have no role in lowering the temperature and can further insult the liver or kidneys—forget these fever reducers. Instead, focus your drug therapy on limiting heat production: refer to local protocols to determine whether a benzodiazepine such as diazepam can be used to control any inappropriate shivering.

Treating heat illness

Pre-hospital providers should adhere to any local protocols for handling heat illness. In the absence of specific local guidance, you may consider treating and releasing on-scene any heat exhaustion and cramps that improve with passive cooling, rest, and oral rehydration. Recommend transport and

emergency department care for any patient who has complicating underlying medical conditions, feels unwell with a core temperature over 102, receives IV fluid resuscitation, has AMS even if it resolves with treatment, and any patient for whom a disturbance of sodium levels is suspected.

Keep it fun

Summer brings a unique set of risks and activities, and a familiar set of challenges for pre-hospital providers. This year, as you approach patients exposed to the sun in all its glory, think about the big three—salt, sugar, and heat. This mantra will solve many patients' small problems, may help you diagnose their dangerous ones, and if nothing else, it will get you ready for a rack of Memphis-style ribs at the end of the day.

For more details on the science and background of heat-related illnesses, you can refer to the Wilderness Medical Society's Clinical Practice Guideline for the Evaluation and Treatment of Heat-Related Illnesses.

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	Prevention & Preparation	Treatment	
		Exhaustion/Cramps Pathway	Heat Stroke Pathway
First Responder	<ul style="list-style-type: none"> <input type="checkbox"/> Encourage hydration with a “drink to thirst” approach <input type="checkbox"/> Ensure that a shaded or cooled environment is available for patient assessment and treatment <input type="checkbox"/> Secure ice, cool drinks, and food for treating patients <input type="checkbox"/> Consider ways of maintaining chilled intravenous fluids 	Remove from hot environment, loosen clothing, rest, drink to thirst, apply ice packs if desired	AMS* or not improving after 15 minutes: Give nothing by mouth and activate the next tier of emergency response system
EMT		Oral temperature <102F <ul style="list-style-type: none"> <input type="checkbox"/> Priority: optimize passive cooling <input type="checkbox"/> Supportive care, drink to thirst <input type="checkbox"/> May treat and release if symptoms resolve 	Oral temperature >102F OR failure to improve with conservative management <ul style="list-style-type: none"> <input type="checkbox"/> Blood glucose check <input type="checkbox"/> Priority: start active cooling measures <input type="checkbox"/> Evaporative measures preferred first line <input type="checkbox"/> Apply ice packs if more appropriate for your situation <input type="checkbox"/> Transport emergently

Paramedic		<p>Oral temperature <102</p> <ul style="list-style-type: none"> <input type="checkbox"/> Priority: optimize passive cooling <input type="checkbox"/> Supportive care, drink to thirst <input type="checkbox"/> IV access <input type="checkbox"/> Normal saline bolus 500-1000mL <input type="checkbox"/> Ondansetron 4mg PO, SL, or IV, may repeat once <input type="checkbox"/> May treat and release if symptoms resolve 	<p>Oral temperature >102F <u>OR</u> failure to improve with conservative management</p> <ul style="list-style-type: none"> <input type="checkbox"/> Blood glucose check <input type="checkbox"/> Priority: start active cooling measures <input type="checkbox"/> IV/IO access <input type="checkbox"/> 20mL/kg normal saline bolus. May repeat 10mL/kg <input type="checkbox"/> Midazolam 0.5mg/kg IV or IO as needed to diminish shivering <input type="checkbox"/> Transport emergently
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Table 1. Pre-hospital approach to heat-related illness prevention and treatment. Modified from Saint Louis Fire Department Adult Treatment Protocols on Heat stroke/hyperthermia (2014) and Heat exhaustion/cramps (2014). *AMS: altered mental status.