

Exertional Heat Illnesses

Heat syncope

- Peripheral vasodilatation and pooling of blood leading to decreased cardiac output and stroke volume and thereby introducing transient loss of consciousness.

Diagnosis - based on signs and symptoms

- Normal core temperature
- Brief episode of fainting, improved with supine position
- Dizziness, tunnel vision
- Pale and wet skin
- More common in athletes that have been standing for long periods of time or those who have stopped exercising suddenly

Heat Cramps

- Involuntary, painful contractions of large muscles during or after prolonged exercise often induced by large sodium losses via sweat in conjunction with copious water consumption
 - Thought to be from decreased sodium and chloride
- Studies have shown that cramp prone athletes can lose twice the sodium in sweat as non-cramp prone athletes
- May be difficult to determine whether cramps in athletes with sickle cell trait are due to heat cramps or sickle cell crisis.
- Neuromuscular fatigue leads to abnormalities in mechanisms that control muscle contractions and may cause cramping

Diagnosis - based on signs and symptoms

- Commonly affect hamstrings, gastrocnemius, and soleus muscles
- Common after strenuous long exercise periods
- May see “salt stains” on skin or clothes from excess sodium loss
- Normal Central Nervous System (CNS) function

Heat Exhaustion

- The inability to continue exercise in heat
- Most common form of heat illness seen in athletes
 - Does not necessarily progress to heat stroke; heat exhaustion and heat stroke are separate entities but occur under similar hot weather conditions

Diagnosis-based on signs and symptoms and **by exclusion of other serious conditions** (see list below)

- Inability to continue exercise in the heat, collapse

- Core body temperature (rectal) may be elevated (102-104°F) but within normal limits for an exercising individual
- CNS dysfunction
- Tachycardia (rapid or accelerated heart rate)
- Pale and wet skin, sweating
- Nausea and/or vomiting
- Headache, dizziness, and/or faintness
- Rapid/shallow breathing, weak pulse
- Thirst
- Rule out **other serious conditions** that may be present such as:
 - Exertional Heat Stroke
 - Head Injury
 - Cardiac Problems
 - Exertional Sickling

Exertional Heat Stroke (EHS): Medical Emergency

- Occurs when heat generation exceeds heat loss leading to a rise in core body temperature and thermoregulatory failure
- A serious, life-threatening condition requiring immediate medical attention
- It is separated from heat exhaustion by the CNS dysfunction in combination with a dangerously high core body temperature

Diagnosis-based on signs and symptoms

- High core-body temperature (>104°F or 40°C)
 - Rectal temperature should be used for accurate temperature reading. Other devices may give false readings and should not be used in the absence of a valid device
- CNS dysfunction, such as altered consciousness, coma, convulsions, disorientation, irrational behavior, decreased mental acuity, irritability, emotional instability, confusion, hysteria, or apathy

These first two signs/symptoms will distinguish EHS from other serious conditions and are the main diagnosis criteria that should be used

Other signs and symptoms that may be present:

- Hot, sweaty skin
- Rapid pulse rate (>160 BPM)
- Rapid respirations (>20 per min)
- Decreased blood pressure
- Nausea, vomiting or diarrhea

- Headache, dizziness or weakness

MANAGEMENT OF HEAT ILLNESS

- **At first signs of heat illness, remove athlete from participation**

Heat syncope Treatment

- Place athlete in laid back position with legs elevated above head level
- Remove an excess clothing/equipment
- Place athlete in cool shaded environment
- Monitor vital signs
- Oral hydration if dehydration is present

Heat Cramp Treatment

- Place in cool shaded environment
- Passive stretching of painful affected muscles
- Remove constrictive clothing/equipment
- Re-establish normal hydration status
 - Additional sodium may be needed

Heat Exhaustion Treatment

- Place athlete in cool shaded environment
- Remove excess clothing and equipment
- Cool athlete with fans, ice towels, water dousing and move them to an air-conditioned or shaded/cool environment
- Rehydrate orally with sports drink or water if athlete is not experiencing CNS dysfunction. Evaluate need for IV fluids
- Check core temperature (rectal) if exertional heat stroke is suspected or improvement not seen in the first 5-10 minutes of treatment
- Transport to an emergency facility if recovery is not prompt and EHS has been ruled out. If symptoms persist following 10-15 minutes of treatment and EHS is suspected, begin more aggressive cooling therapy (full body immersion)

Exertional Heat Stroke Treatment

Call EMS and prepare to cool the athlete

- Immediate whole body cooling and rapid reduction of core body temperature within 15 minutes is priority
- Remove equipment and excess clothing
- **“Cool first, transport second”**
- Ambulatory aids should be readily available for transport and guidelines should be reviewed with EMS annually

Transport or assist athlete to cold tub

- Cold tub should be readily available when heat index is greater than 90°F
- Cold tub or cooling tank should be centrally located, shaded if possible, and readily accessible to EMS

Determine Vital Signs

- Assess core body temperature
 - Continuous monitoring of temperature during immersion therapy is recommended
 - Utilize a sheet/towel for privacy when assessing core temperature
- Maintain ABCs and monitor vital signs
- Assess and monitor CNS status

Begin Ice Water Immersion

- Place the athlete in the ice water immersion tub up to neck/chest level
- Ice chests filled with ice should accompany the cold tubs. In the event that immersion is needed, ice should be mixed into the water just prior to immersion to ensure the water temperature is below 60 °F/15°C
- Sports Medicine staff, coaches, volunteers, may be needed to assist with a smooth and safe entry and exit from the cold tub
- If full body coverage is not possible due to the athlete or container’s size, cover the torso as much as possible
- To keep the athlete’s head and neck above water, an assistant may hold the athlete under the armpits with a towel or sheet wrapped across the chest and under the arms
- Place an ice/wet towel over the head and neck while body is being cooled in tub
- Water may be circulated or stirred to enhance the water-to-skin temperature gradient, which optimizes cooling

Vital signs should be monitored at regular intervals, every 5-10 minutes

Cooling Duration

- Continuing cooling athlete until temperature lowers to 102°F or lower
- If rectal temperature cannot be measured and cold water immersion is indicated, cool for 12-15 minutes and then transport to a medical facility via EMS
- Remove the athlete from the immersion tub only after core temperature reaches 102°F and then transfer to the nearest Emergency Room via EMS

Fluid Administration

- If conscious and able to orally rehydrate administer fluids
- If a qualified medical professional is available, an intravenous fluid line should be administered

If cold water immersion is not available or feasible given the constraints of the athletic activity being performed or location, then cooling via other means is necessary

- Alternative cooling methods
 - Ice Towels
 - Ice Bags
 - Cold water dousing from a locker room shower or from a hose.

RETURN TO ACTIVITY

- If an athlete has experienced any of the previous heat related illnesses, he or she should be evaluated by a physician to determine a return to play strategy. Athletes with exertional heat stroke should avoid participation of any kind, and exercise for a minimum of one week.

REFERENCES

- 1) H. Binkley et al, National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses, *Journal of Athletic Training* V. 37; Jul-Sep 2002
- 2) Korey Stringer Institute, University of Connecticut-Cold Water Immersion Cooling Guidelines,
<http://ksi.uconn.edu/resources/coolwaterguide.html> July 2010
- 3) Armstrong, LE. 2003 Exertional Heat Illnesses. In *Exertional Heatstroke: A Medical Emergency*, edited by Douglas J. Casa and Lawrence E. Armstrong, 29-56. Illinois: Human Kinetic Publishers, Inc.

HEAT ILLNESS RISK FACTORS

Intrinsic Risk Factors

- History of exertional heat illness or cramping

- Presence of a fever, other illness, skin condition (sunburn), or medical condition such as “Sickle Cell”
- Inadequate heat acclimatization
- Dehydration
- Intensity unmatched to physical fitness
- Barriers to evaporation (equipment)
- Overweight athletes/athletes with a high body-mass index
- Heavy or “salty” sweaters, or athletes who lose >3% weight loss during activity
- Medications or supplements (diuretics, ephedrine, antihistamines)
- ADD/ADHD medications
- High intensity athletes, tendency to push oneself
- Salt deficiency/athletes on restricted or low salt diets

Extrinsic Risk Factors

- Vigorous activity in hot-humid environment
 - Typically >1 hour or prolonged exercise with minimal breaks
 - Wet bulb globe temperature can help determine proper exposure
- High temperature, humidity, and sun exposure
- Equipment-dark colors, heavy clothing, helmets, and other protective equipment
- Inadequate rest breaks
- Inappropriate work/rest ratios based on exercise intensity, clothing, fitness, heat acclimatization, or medical conditions
- Lack of education or awareness among coaches, athletes and medical staff
- No access to shade or fluids during rest breaks
- Delay in recognition of early heat illness warning signs and lack of proper medical care