

# Sports Shorts

GUIDELINES FOR PEDIATRICIANS

## Heat Illness in Athletes

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### EPIDEMIOLOGY

According to the Centers for Disease Control and Prevention (CDC), heat-related illness accounts for around 400 deaths annually in the United States. Furthermore, heat-related deaths in sports appear to be on the rise over the last 40 years with football being the sport with the highest risk. In high school and college football, heat illness was the third most common cause of sports-related fatalities from 1990-2010, based on data from The National Center for Catastrophic Sports Injury Research database. As the late summer sports season approaches, it is important for pediatricians to have a thorough understanding of heat illness and its effect on young athletes.

### THERMOREGULATION

At lower ambient temperatures and with less vigorous activity levels, heat is lost from the body via three basic mechanisms: conduction (direct contact), convection (air circulation) and radiation (electromagnetic waves). As temperatures rise, the body relies more on evaporation of sweat to dissipate heat. If heat-dissipating mechanisms fail, or there is overwhelming heat stress (high temperature/humidity, relatively windless air), core temperatures begin to rise, which can lead to heat illness.

### RISK FACTORS

Among other factors (see table below) children may be at higher risk of heat illness for multiple reasons. Their high surface area to body mass ratio causes them to absorb relatively more heat from the environment under hot and sunny conditions. Kids sweat less and produce more metabolic heat per given mass than adults. Also, children acclimatize more slowly to the heat and require greater core temperature increases to induce sweating.

### RISK FACTORS FOR HEAT ILLNESS

- Previous history of heat illness
- Poor physical conditioning
- Young or old age
- Poorly acclimated to heat
- Obesity
- Febrile or gastrointestinal illness
- Certain medical conditions (e.g. Cystic Fibrosis, Diabetes, cardiovascular disease, sweating dysfunction)
- Certain medications (e.g. stimulants, anticholinergics, cardiovascular meds, illicit drugs, alcohol, supplements)
- Sunburn
- Lack of sleep
- Heat retaining uniforms/protective equipment

The severity of heat illness varies, from mild forms like heat edema and heat rash, to life-threatening conditions such as heat stroke. The common types of heat illness are described in the table below, along with their typical symptoms associated body temperature.

### TREATMENT

Treatment for all forms of heat illness should begin with assessment of airway, breathing, circulation (ABCs) and body temperature and by moving the athlete to a cooler environment. Heat edema,

generally improves with rest and elevation of the involved extremity and by ensuring the athlete is well hydrated and has adequate salt intake. For heat rash, cool the affected area and remove occluding clothing as appropriate. Anti-inflammatory lotion may be applied to relieve symptoms and shorten duration of rash. Athletes that have collapsed due to heat syncope should be placed supine in a cool location with legs elevated to help restore adequate cerebral blood flow. Oral fluids should be given as tolerated, although IV hydration may be required. Heat cramps can be treated with fluid/electrolyte replacement, stretching, ice and massage. Mild heat exhaustion with normal vital signs may require no more than oral hydration and removal from the heat. However more severe symptoms should be addressed with rapid cooling with ice packs in the groin and axilla, IV fluids and repeated monitoring. Heat stroke is the most severe of the heat-illness syndrome and therefore demands aggressive treatment to prevent complications (exertional rhabdomyolysis, electrolyte disturbance, seizure, hypotension, arrhythmia, liver damage). If rectal temperature is  $> 40^{\circ}$  Celsius, EMS should be called. Clothing should be removed and rapid cooling commenced, ideally by submersion in an ice or cold water bath, while monitoring for signs of hypothermia (shivering). If submersion is unavailable, ice packs and evaporative cooling with tepid to cool water spray and fanning should be used.

### RETURN TO PLAY

No evidence-based guidelines exist to direct return to play decisions. For mild forms of heat illness, it is probably safe for athletes to return within 24 hours with proper hydration. After heat stroke, athletes should be evaluated by a physician to assess any risk factors. In general, they should wait at least 1 week before resuming exercise, first in a cool environment with light activity and then gradually progress intensity, heat exposure and amount of equipment.

### PREVENTION

The American Academy of Pediatrics (AAP) published a policy statement in 2011 outlining a detailed strategy to prevent heat illness in exercising children and adolescents. Key elements are summarized below.

- Emphasize heat illness education to athletes and those who oversee athletic programs/events
- Develop an emergency action plan for all youth athletic activities including having trained personnel and facilities capable of treating all forms of heat illness
- Allow athletes to gradually acclimate to exercising in heat over a 10-14 day period
- Athletes should consume sufficient fluid before, during and after exercise to maintain hydration
- Modify or cancel activity as needed during times of increased heat, avoid or limit exercise in the heat when ill and stop exercise if symptoms of heat illness develop
- Allow at least two hours of rest and recovery between contests in hot weather

Condition	Signs/Symptoms	Body Temperature
Heat Edema	Peripheral swelling, more common in older population	Normal
Heat Rash	Itchy, papulovesicular rash over clothed areas	Normal
Exercise Associated Collapse/Heat Syncope	Dizziness, weakness, loss of postural control	Normal
Exercise Associated Muscle Cramps	Painful muscle contractions	$< 40^{\circ}$ C
Heat Exhaustion	Dizziness, nausea/vomiting, headache, flushing, sweating, cold clammy skin	$\leq 40^{\circ}$ C
Heat Stroke	Hot skin +/- sweating, altered mental status	$> 40^{\circ}$ C