EXERTIONAL HEAT ILLNESS: PREVENTION AND TREATMENT RECOMMENDATIONS

Introduction

Exertional Heat Illness (EHI) can range from a simple muscle cramp to life threatening heat stroke. By following the recommendations found in this document, the risk of EHI, including catastrophic heat stroke can be reduced significantly. Important components in preventing EHI are:

- Identification of “at risk” athletes
- Proper acclimatization
- Prevention of dehydration
- Activity modification based on the environmental conditions

Equally as important is the proper recognition and treatment of the athlete with EHI. These guidelines are created for the protection of students participating in school athletics and other activities such as marching band and ROTC.

Prevention

Identification of students at increase risk of EHI

Pre-Participation Examinations (PPE)

All students are required to obtain an annual pre-participation physical examination from a licensed physician before participating in any school sponsored athletics. NO STUDENT ATHLETE SHALL PARTICIPATE IN ANY SCHOOL ATHLETIC ACTIVITY OF ANY KIND TO INCLUDE ALL PRE-SEASON CONDITIONING, TRYOUTS, PRACTICES AND COMPETITIONS WITHOUT A PRE-PARTICIPATION EXAMINATION.

1. ATC will identify athletes at increase risk of EHI by screening all PPEs with attention to the following questions:
   a. (#11), Are you currently taking any medicines or do you take any medicines on a regular basis (prescription or over the counter)?
   b. (#12), Have you ever taken any supplements or vitamins to help with weight loss, weight gain, or improve performance?
   c. (#19), Have you ever become ill from exercising in the heat?

2. ATC will also consider height & weight and body composition as a risk factor.

3. ATC will note use of medications associated with an increase risk of EHI.

4. ATC will interview and educate at risk athletes on prevention plan.
5. ATC will document those athletes identified to be at increased risk of EHI and notify head coach and position coach.
   ✓ Jersey numbers and/or colored bibs may be helpful in monitoring athletes identified to be at increased risk for EHI.

Pre-season Heat Acclimatization

Proper acclimatization to the heat is an important component in the prevention of EHI. Heat acclimatization is the body's adaptation to repeated exposures to hot weather in which the athlete's ability to withstand heat stress is improved. A lack of acclimation to the heat and poor cardiovascular fitness are prominent contributors to heat illness in student athletes.

- Acclimatization improves the sweating mechanism of athletes. As a result, the dissipation of heat is enhanced reducing the risk of heat illness.
- Good cardiovascular fitness and proper hydration enhance the acclimatization process.
- In children and adolescents, this process can take 10-14 days. **The first 2-3 days of preseason athletic practice present the greatest danger for serious heat illness** because student athletes often report for practice insufficiently acclimated to the heat and/or in a poor state of cardiovascular fitness.
- Athletes should be encouraged to participate in summer workouts and conditioning programs. The program should be designed to provide a gradual increase to heat exposure throughout the summer months to promote acclimatization.
- Coaches should be aware of the need for proper acclimatization during the first two weeks of practice and plan their practice schedule and training activities accordingly.
- A proper acclimatization schedule should also be initiated for any athlete that begins participation at a later date than the team

Environmental Recommendations:

1. **Schools should designate a shaded area for:**
   ✓ Heat illness treatment
   ✓ Group cooling & hydration during rest periods

2. **Coaches and ATCs must be familiar with the recommendation for activities related to Heat Stress Risk outlined in the National Athletic Trainer’s Association Position Statement.**

3. **To determine heat index the following methods may be used:**

**Figure 1. Risk of heat exhaustion or heat stroke while racing in hot environments. However, Figure 2 may be better suited for estimating heat-stroke risk when equipment is worn. Reprinted with permission from Convertino VA, Armstrong LE, Coyle EF, et al. American College of Sports Medicine position stand: exercise and fluid replacement. Med Sci Sports Exerc. 1996;28:i–vii.**
✓ hand-held digital device
✓ sling psychrometer
✓ reliable internet source

4. Heat Index should be measured and documented:
✓ Within 30 minutes prior to the start of practice
✓ Every 30 to 60 minutes during practice
✓ May through September and in the event of any unusually hot/humid days during other months.

5. Forecasted heat index information can be useful for practice planning.

Rehydration

Maintaining hydration status in athletes with high sweat rates, in sports with limited fluid access, and during high-intensity exercise can be difficult, and special efforts should be made to minimize dehydration. During prolonged exercise in hot and humid conditions, the body’s sweat rates may exceed the body’s ability to rehydrate. Fluid replacement should meet the sweat rate for each individual. Net fluid loss experienced in these conditions must be regained within 24 hours, prior to the next practice session. Water loss that is not regained by the next practice increases the risk for EHI. Body-weight change and urine color monitoring are the preferred methods to monitor for dehydration in the field. Daily weigh in and weigh out is recommended to maintain awareness of overall cumulative fluid losses and appropriate rehydration or restriction of activity can be implemented.

- To ensure proper pre-exercise hydration, the athlete should consume approximately:
  ✓ 17 to 20 oz. of water or a sports drink 2 to 3 hours before exercise and
  ✓ 8 to 12 oz. of water or a sports drink 10 to 20 minutes before exercise
- During exercise, periodic drinking should be enforced through mandatory water breaks – even if the student athlete does not feel thirsty as thirst may not appear until the athlete is already significantly dehydrated. Adequate fluid supply should be readily available at all times and student athletes should be allowed access to fluids 100% of the time during activity in hot/humid weather.
  ✓ 8 to 12 oz. every 10 to 20 minutes.
- Post-exercise hydration should aim to correct any fluid loss accumulated during the practice or event. Ideally completed within 2 hours, rehydration should contain water to restore hydration status, carbohydrates to replenish glycogen stores, and electrolytes to replace those lost in sweat and to speed rehydration.

RECOMMENDATIONS:

- Pre- and post-practice weights are useful for assessing for levels of dehydration which generally occurs with the loss of > 2% of body weight.
  ✓ Dehydration of just one to two percent of body weight can negatively influence performance.
  ✓ Dehydration of greater than three percent of body weight increases an athlete’s risk of EHI.
- Athletes should be encouraged to check the color of their urine prior to exercising. A dark yellow or gold color suggests dehydration. Proper hydration results in a very light colored or clear urine.
- After exercise fluid replacement should be at a rate of 20 - 24 oz for every pound of body weight lost after exercise.
- Athletes having in a dehydrated state due to a recent fever or gastro-intestinal illness (vomiting and/or diarrhea) or previous history of heat illness are at a much higher risk for EHI and should be monitored closely or placed on a modified participation schedule.
- Medications including diuretics, antihistamines, beta blockers and anti-cholinergics increase the risk of heat illness.
- Energy, ergogenic, and dietary supplements such as Creatine may cause an increase in dehydration and heat related illness.

**Recognizing and Treating the Athlete with EHI**

Early recognition and prompt treatment of an athlete with signs or symptoms of exertional heat illness is a critical factor in preventing progression of the condition and catastrophic death due to heat stroke. Coaches and ATCs must be aware of the potential for development of EHI despite appropriate water breaks and moderate environmental conditions. In addition, they must be aware of those athletes that are at increased risk.

**Signs and Symptoms of EHI**

The signs and symptoms of EHI depend on several factors including the severity of the condition, and can vary from athlete to athlete. An abbreviated list of some of the more common signs and symptoms follows (see National Athletic Trainers’ Association Position Statement: Exertional Heat Illnesses for a complete list). Any athlete who is exercising in the heat and develops one or more of these findings should be considered to possibly be suffering from EHI.

- Weakness/ fatigue
- Dizziness/lightheadedness
- Headache
- Nausea
- Vomiting
- Muscle cramping

**Treatment of EHI**

**Cramping**

Cramping in a single muscle group with no other signs or symptoms of EHI, can generally be managed by gentle stretching and massage of the involved area. The athlete should be encouraged to hydrate orally with an electrolyte containing sports drink. He/she can return to participation once the cramping has resolved and they demonstrate that they can perform the necessary activities of the sport.

Muscle cramping in several muscle groups or total body cramping suggests more significant dehydration and/or electrolyte deficiency. In this case, the athlete should be moved to a cool environment and hydrated orally with an electrolyte containing sports drink. Gentle stretching and massage of the affected areas may be helpful. However, if the cramping does not resolve quickly, transport to a medical facility for further treatment is necessary.

Athletes who suffer repeated bouts of cramping despite attention to proper fluid and electrolyte intake should be referred to a physician for further evaluation.
Heat Exhaustion
The athlete with heat exhaustion typically has difficulty in continuing to exercise with an obvious decrease in performance. They may exhibit one or more of the signs of symptoms of EHI (see list above).

The athlete should be immediately moved to a cool, preferably air-conditioned, area and all equipment and excess clothing removed. Ice bags should be applied to the neck, armpit and groin areas. Legs should be elevated above the level of the heart. Vital signs (blood pressure and pulse rate) should be monitored. If vital signs remain stable and there are no mental status changes and the athlete is not nauseated or vomiting, oral hydration with an electrolyte containing sports drink can be initiated on-site.

If the athlete does not show rapid improvement with the above measures, transport to a medical facility should be initiated immediately. Intravenous rehydration may be necessary in these cases.

Any athlete who experiences an episode of heat exhaustion should not be returned to practice or any form of physical exertion that day. Complete rehydration should be assured before the athlete resumes exercising. Depending on the severity of the condition, follow-up with a physician prior to return to activity may be indicated.

Heat Stroke
Exertional heat stroke results from an inability to maintain body temperature within a safe range. Heat loss through the sweating mechanism is unable to keep up with the body’s heat gains leading to a progressively rising core temperature. This elevated temperature can result in organ damage and is a potentially fatal condition. Although exertional heat stroke is generally a preventable condition, deaths due to exertional heat stroke continue to occur each year in athletes in the United States.

The hallmarks of exertional heat stroke are a core temperature at or above 104 degrees Fahrenheit (F) and an altered mental status. Therefore, any signs or symptoms of an alteration in mental status in an athlete exercising in hot and/or humid conditions must be considered suggestive of impending heat stroke and must be cause for emergency measures. Common signs of altered mental status may include one or more of the following:

- Confusion/disorientation
- Irritability/hysteria
- Unusual behavior
- Seizures
- Drowsiness
- Loss of consciousness

Determining the core body temperature is a critical step in assessing an athlete with possible heat stroke. Core temperature determinations using a thermometer placed in the mouth or armpit, or a tympanic (ear) thermometer are unreliable. Core body temperature can only be determined reliably by rectal temperature. A rectal thermometer should therefore be used to accurately assess core body temperature.

The single most important factor leading to organ failure and death in an athlete suffering from heat stroke is the amount of time the core temperature remains at dangerously high levels. Therefore, the immediate implementation of rapid total body cooling is the most effective means of preventing these catastrophic complications. This is best accomplished by immersing the athlete in an ice water bath.

In any case of suspected exertional heat stroke, EMS should be notified immediately. Provided that adequate emergency medical care is available on-site (i.e., ATC, EMT or physician), it is...
recommended to cool first via cold water immersion, then transport second. **Total body cooling of the athlete should be initiated immediately on-site in an ice water bath prior to transportation to an emergency medical facility.** Core temperature should be monitored with a rectal thermometer or thermistor along with vital signs during the cooling process. Once core temperature comes down to 101 –102 degrees F., transportation via EMS to the nearest emergency medical facility may proceed. If other complications develop that would be considered life threatening (i.e., airway, breathing, circulation), immediate transport to the nearest medical facility is essential.

If immersion is not possible, transport immediately. Alternative cooling strategies should be implemented while waiting for and during transport. These strategies should include: ice bags applied to the neck, groins and armpits or ice over as much of the body as possible and/or cold towels (replace towels frequently), spraying the body with cold water and use of fans.

In summary, in order to recognize and treat heat stroke effectively, it is necessary for schools to have the following:

- A written emergency plan in place outlining the steps to be taken in the case of an athlete with suspected heat stroke. The athletic trainer and coaching staff must be familiar with and understand the emergency plan.
- A tub or pool in close proximity to the athletic field large enough to immerse the athlete’s legs and torso in order to initiate the rapid total body cooling process.
- Availability of enough ice to maintain the water temperature at 35 – 58 degrees F. during the cooling process.
- A rectal thermometer or thermistor to assess and monitor core temperature.

**Any athlete who suffers from exertional heat stroke should not be returned to athletic participation of any kind without formal evaluation and written permission by the athlete’s physician.** Whenever possible, the athletic trainer should discuss return to participation precautions and guidelines with the athlete’s physician.

**Recommend:**

For effective EHI treatment all schools should have:

- Large tub for total body emersion
- Availability of adequate amount of ice
- Capability of measuring/monitoring rectal temperature
- Designated area for emergency treatment