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"Combating Heat-related Illnesses"

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# Combating Heat Related Illness

Wednesday August 11, 2010  
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## Outline-Topics

- 1. Body's temperature regulation
- 2. Mechanisms, signs/symptoms of exertional heat illness
- 3. First aid care for exertional heat illness
- 4. Return to play guidelines
- 5. Hydration
- 6. Prevention strategies

## Regulation of Temperature Change

- Normal, healthy skin
  - Thermoreceptors: detect temperature change
- Signal sent to Hypothalamus
  - If heat:
    - Increase peripheral blood flow to skin (sweating)
  - If cold
    - Decrease peripheral blood flow to skin (shivering)
- Some conditions/disease affect this
  - Reynaud's phenomenon

## Heat Dissipation

- Body dissipates heat by:
  - Metabolic heat production
  - Conduction
  - Convection
  - Radiation
  - Evaporation

## Metabolic Heat Production

- Normal metabolic function
  - Production and radiation of heat
  - Depends upon intensity of physical activity
  - Higher the metabolic rate, more heat is produced

## Conduction

- Transfer of heat from one material to another through **DIRECT CONTACT**



## Convection

- Moving heat from one place to another by the motion of gas/liquid across the surface



## Radiation

- Primary method for discharging body's heat at rest
- Energy transfers from higher energy surface to lower energy surface

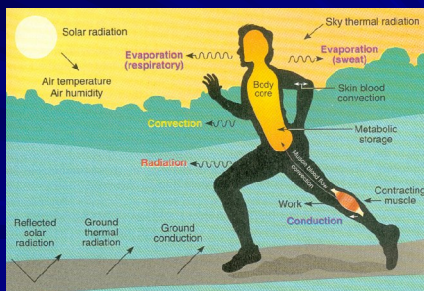


## Evaporation

- Primary way for body to dissipate heat during exercise
- As fluid evaporates, heat is lost
- Greatly affected by environmental factors
  - Water saturation in air
  - Velocity of air



## Heat Dissipation



## Nonenvironmental Factors

- Dehydration**
  - Easiest way to monitor is by urine color
- Barriers to evaporation**
  - Equipment
  - Clothing (material)
- Illness**
  - Fever
- History of Heat Illness**
- Body mass/size**
  - Both obese and well muscled athletes
- Physical condition**
- Excessive or dark colored clothing**
- Overzealousness**

## Factors

- Environmental:
  - Air Temperature
  - Radiant Temperature
  - Humidity
  - Air Movement
- Individual
  - Body build
  - Body composition
  - Age

## Exercise/Heat Cramps

- Least serious heat emergency
- Individual muscle bundles contract and spasm
  - Calves, hamstrings, quadriceps
- Result of sodium and electrolyte loss through excessive sweating and lack of hydration

## Exercise/Heat Cramps

- Signs/Symptoms
  - Transient muscle cramp
  - Fatigue
- Treatment
  - Mild stretching
  - Ice massage
  - Sports drink
  - Relaxed position in shade/cool area

## Heat Syncope (heat collapse)

- Rapid physical fatigue during overexposure to heat
  - Standing long periods in heat
  - Immediately after stopping exercise
  - Stand up quickly
- Caused by peripheral vasodilation of superficial vessels
  - Fainting, nausea, dizziness, tunnel vision, pale/sweaty skin, lightheadedness, decreased pulse rate

## Heat Syncope (heat collapse)

- Laying down in cool environment
- Replace fluids
- Elevate legs above level of head

## Heat Exhaustion

- Inability to continue exercising with any combination of:
  - Heavy sweating
  - Dehydration
  - Sodium loss
  - Energy depletion
- Difficult to distinguish from Exertional Heat Stroke without measuring rectal temperature

## Heat Exhaustion

- Signs and Symptoms
- Normal or elevated core body temperature
- Dehydration
- Dizziness
- Lightheadedness
- Syncope
- Headache, nausea, decreased urine output

## Heat Exhaustion

- Persistent muscle cramps
- Pallor (pale)
- Profuse sweating
- Chills
- Cool, clammy skin
- Intestinal cramping
- Urge to defecate
- Hyperventilation

## Heat Exhaustion

- Can show heat cramping first (not rule)
- Deterioration in physical performance
- Cognitive changes are usually minimal

## Heat Exhaustion

- Treatment:
- Remove equipment, clothing to increase evaporative surface area
- Ingestion or intravenous replacement of fluids
- Obtain core temperature (rectal)
- Fans, ice towels, ice bags to facilitate cooling
- Cool or shaded area
- Transfer to medical care facility if no recovery

## Exertional Heat Stroke

- **Medical Emergency**
- Must seek treatment immediately
- Failure and shutdown of the body's thermoregulatory system
- Heat is generated by muscle exercise which is unable to be dissipated into the environment
- Occurs when exercising in hot, humid environment

## Exertional Heat Stroke

- Signs and Symptoms
  - Hysteria
  - Irritability
  - Apathy
  - Delirium
  - Disorientation
  - Staggering
  - Seizures
  - Loss of Consciousness
- High core body temperature (104°)
- Central Nervous System changes
  - Dizziness
  - Drowsiness
  - Irrational behavior
  - Confusion
  - Emotional instability

## Exertional Heat Stroke

### ■ Signs and Symptoms

- Dehydration
- Weakness
- Hot and wet or dry skin
- Tachycardia (100 to 120 beats per minute)
- Hyperventilation
- Vomiting
- Diarrhea

## Exertional Heat Stroke

### ■ Treatment:

- Cool as rapidly as possible
- Full body immersion in water 35° to 59° F
- Aggressive cooling is most critical factor
- Fluids orally or intravenously
- Transport ASAP to nearest medical facility



## Exertional Heat Stroke

### ■ Pathphysiology:

- Overheating of organ tissues → malfunction of temperature control center in brain
- Circulatory failure
- Severe lactic acidosis
- Hyperkalemia (↑ potassium in blood)
- Acute renal failure

## Prevention

1. Appropriate medical staff on-site
  1. EAP
  2. Familiar with signs of heat illness
  3. ATC's allowed to attend to victims and restrict from participation
2. Conduct thorough PPE
3. Acclimatization
4. Education (coaches, athletes, parents)
  1. Signs and symptoms
5. Educate on fluid intake

## Prevention

- Cool Zone equipment
- Wet/ice towels
  - Commercial
- New materials
  - No cotton
- Easy access to water/sports drink



## Exertional Hyponatremia

- Rare condition
  - Water intoxication
  - Low sodium levels in system
- 2002 Boston Marathon
  - 28 female died following marathon
  - Only documented death
- Events lasting longer than 4 hours
  - Ingest too much water, not enough sports drink
- Cells swell with water and burst



## Exertional Hyponatremia

- Signs/Symptoms
  - Disorientation
  - Altered mental status
  - Headache
  - Vomiting
  - Lethargy
  - Swelling of extremities
  - Pulmonary edema
  - Cerebral edema
  - Seizures
- Match water with electrolyte solution

## Exertional Hyponatremia

- Differentiate between heat exhaustion and hyponatremia
  - Severe headache
  - Significant mental compromise
  - Altered consciousness
  - Swelling in extremities
- Immediate transfer to medical facility

## Return to Activity

- Heat cramp/heat syncope
  - Discuss with supervising physician
- Heat exhaustion NOT needing transfer to hospital
  - Discuss with supervising physician
- Heat exhaustion transferred or Heat Stroke
  - No activity until cleared by physician

## Hydration

- All athletes should begin each session well hydrated
- Proper planning for hydration based on sport, practice vs. game, location, etc.
- Individual bottles recommended to ease monitoring of fluid intake

## Hydration

- Simple way to measure: body weight change
- $\frac{\text{Pre exercise weight} - \text{post exercise weight}}{\text{pre exercise weight}} \times 100$ 
  - % body weight change
  - +1 to -1 well hydrated
  - -1 to -3 minimal dehydration
  - -3 to -5 significant dehydration
  - >-5 serious dehydration

## Hydration

- Pre-exercise:
  - 17 to 20 fl oz, 2-3 hours before exercise
  - 7 to 10 fl oz, 10 to 20 minutes prior
- Goal is to maintain a <2% change in body weight
- $\text{Sweat rate} = \frac{\text{pre ex weight} - \text{post weight} + \text{fluid intake} - \text{urine volume}}{\text{exercise time in hours}}$

## Hydration

- Fluid temperature influences amount consumed (50 to 59 °)
  - Flavor also a factor
- Consumption of carbohydrates can be beneficial
  - Sports drinks
  - Recommended for post exercise consumption
    - Event lasting longer than 45 minutes

## Heat Acclimatization

- Preparticipation physical examination
  - Identify pre-existing conditions
- Heat Acclimatization Period:
  - Initial 14 consecutive days of preseason practice
- Goal: enhance exercise heat tolerance and ability to exercise safely/effectively in warm conditions

## Heat Acclimatization

- Recommendations:
- No more than 6 consecutive days of practice without 1 rest day
  - Rest day: no conditioning, walk-through, etc
- No practice should last longer than 3 hours
  - Includes warm-up, stretching and cool-down
  - Weight room & conditioning activities

## Heat Acclimatization

- Days 1 through 5
  - No more than 1 practice per day
  - Not to exceed 3 hours
  - 1 hour walk through permitted following a 3 hour recovery period
  - Days 1 & 2 helmet only
  - Days 3-5 helmet and shoulder pads
  - Day 6 full pads

## Heat Acclimatization

- No earlier than Day 6 and through Day 14
  - Double practice days must be followed by a single practice day
  - On single practice days, 1 hour walk-through permitted (following 3 hour recovery period)
  - Double practice can follow a double practice day if a rest day falls in between
  - Neither practice should exceed 3 hours
    - 3 hour recover period between practices

## Heat Acclimatization

- Strongly recommended
  - Certified Athletic Trainer on site before, during and after practices

## References

- [www.nata.org](http://www.nata.org)
- Statements
- Preseason Heat-Acclimatization Guidelines for Secondary School Athletics
- Exertional Heat Illness
- Fluid Replacement for Athletes

## Contact

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