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Prevention and Treatment of Athletic Injuries

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Houston, Texas

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Chapter 6

- Environmental Concerns

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Environmental Concerns

- Hyperthermia -
 - Elevated body temperature.

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Environmental Concerns



- Heat Stress:
 - PREVENTABLE
 - Body will function only if body temperature is within a normal range.
 - Maintenance of normal temperature in a hot environment depends on the ability of the body to dissipate heat.

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Metabolic Heat Production



- Normal bodily functions will result in the production of radiation and heat.
- Body heat increases as a result of exercise.
- The amount of increase depends on the intensity of the exercise.
- The higher the metabolic rate, the higher the temperature.

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Conductive Heat Exchange



- Physical contact with other objects and result in heat loss or gain.
- Contact with turf that is hotter than the athlete is a form of conductive heat exchange.

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Convective Heat Exchange



- Body heat can be either lost or gained depending on the temperature of the circulating medium.
- Cool breeze can reduce body heat while a hot day can increase heat.

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Radiant Heat Exchange



- Radiant heat from sunshine causes an increase in body temperature.
- The effects of radiation are much greater then in the sunshine than in the shade.
- To radiate heat from increased metabolism the body dilates superficial arterial and venous vessels, channeling blood to the skin.

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Evaporative Heat Loss



- Sweat glands in the skin allow water to be transported to the surface, where it evaporates, taking large quantities of heat with it.
- When the temp. and radiant heat of the environment become higher than body temp., loss of body heat becomes highly dependent on the process of sweat evaporation.

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Evaporative Heat Loss

- Can sweat 1 qt. / hr for about 2 hours
- The seating does not cool, evaporation does.
- Air must be free of water to evaporate the sweat
- Impaired evaporation at 65% and stops at 75%
- Heat illness increased when humidity is high

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Monitoring the Heat Index

- Heat + Humidity + Sunshine = CAUTION
- Sling psychrometer

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Heat Illnesses

- Heat Rash
- Heat Syncope
- Heat Cramps
- Heat Exhaustion
- Heatstroke

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Heat Rash



- Also called Prickly Heat
- Red, raised rash accompanied by sensations of prickling and tingling during sweating.
- Usually occurs when the skin is continually wet with unevaporated sweat.
- Continually toweling the body can help prevent heat rash.

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Heat Syncope



- Also known as heat collapse
- associated with rapid physical fatigue during overexposure to heat.
- Cause by standing in heat for long periods or by not being accustomed to exercising in the heat.
- Pooling of blood in extremities
- Laying down and replace fluids

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Heat Cramps




- Painful muscle spasms that occur most commonly in the calf and abdomen
- related to excessive water loss and several electrolytes or ions which are essential elements in muscle contraction.
- Prevented by adequate replacement of sodium, chloride, potassium, magnesium, calcium and WATER.

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Heat Exhaustion




- Caused by inadequate replacement of fluids
- Will collapse - Profuse sweating, pale skin, mildly elevated temperature, dizziness, hyperventilation and rapid pulse.
- Put in cool environment and ***REPLACE WATER***

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Heatstroke




- IS SERIOUS!! LIFE THREATENING EMERGENCY!!
- Sudden collapse, loss of consciousness, flushed - hot skin with strong pulse
- Core Temp 106 or higher
- Loss of ability to lose heat with sweating
- GET to ER!

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Preventing Heat Illness




- Heat illness is preventable
- As a coach or athletic trainer, you MUST make it one of your priorities to eliminate the possibility of your athletes having heat problems.

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Fluid and Electrolyte Replacement




- Cold drinks at 45 - 55 degrees tend to empty more rapidly from the stomach than warmer drinks.
- Unlimited access to water
- Water is the BEST
- Sugars slow re-hydration
- NO SALT

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Gradual Acclimatization




- BEST way to AVOID heat stress
- becoming accustomed to the heat and acclimating to exercising in hot temps.
- Get out and work gradually into the exercise program.
- Provide breaks in the shade during the practice.

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Identifying Susceptible Individuals



- Large muscle mass
- Overweight persons are more likely to get heat illness
- Fair skin people
- red hair / blonde hair

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Uniforms




- Short Sleeves
- Perforated
- Color
- Socks

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Additional Thoughts




- Weight Records
- Temp / Humidity Readings
- Table 6-2 Page 147. (for Future Reference)

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Lightning Safety



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How Likely are YOU to be Struck by Lightning?



- Which Do You have a MORE LIKEY Chance of Happening to You?
 - Snake Bite
 - Living through a Nuclear Meltdown
 - Being Struck by Lightning
 - Being Bit by a Shark

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How Many Deaths?



- In the United States, an average of about 100 deaths occur each year.

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Little Known Facts



- Worldwide, approximately 2000 thunderstorms and 50 to 100 lightning flashes occur every second.
- In 1997, the National Lightning Detection Network recorded nearly **27,000,000** cloud-to-ground lightning strikes in the United States.

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How does Lightning Occur



- Static Electricity from updrafts causing positive charges to rise, and negative charges to remain in the lower portion of the thundercloud.
- When enough potential energy is stored, the energy must be released, much like touching a doorknob when a person is loaded with potential static electricity.

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How Powerful is Lightning?



- 10,000 to 200,000 Amps
- Ten Million to One Hundred Million volts!!

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Fact!



- Thunder is caused by the severe heat caused to the air around the lightning strike. Sometimes the temperature is up to 5 times hotter than the surface of the Sun.
- Lightning CAN Occur without Thunder
- **THUNDER CAN NEVER OCCUR WITHOUT LIGHTNING!!**

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Mechanisms of Injury

- A direct strike most commonly occurs to the head, and lightning current enters the orifices.
- This mechanism explains why eye and ear injuries in lightning-strike victims are abundantly reported in the literature.

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Lightning Strike



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Mechanisms of Injury

- The second mechanism, contact injury, occurs when the lightning victim is touching an object that is in the pathway of a lightning current.

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Mechanisms of Injury



- Side flash, the third mechanism, occurs when lightning strikes an object near the victim and then jumps from that object to the victim. This is the main danger to a person who is sheltered under an isolated, tall tree. An upward streamer is triggered by the tree but when this connects with the step leader, the resulting stroke jumps to the victim, who represents an additional pathway to ground.

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Mechanisms of Injury



- The fourth mechanism, a step voltage or ground current, occurs when the lightning current flowing in the ground radiates outward in waves from the strike point. If one of the individual's feet is closer to the strike than the other, a step voltage is created.

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Mechanisms of Injury



- Humans are primarily salt minerals in an aqueous solution, and a lightning current preferentially travels up from the earth through this solution (that is, the person) rather than through the ground. The greater the differential step voltage (ie, the greater the distance between the 2 feet), the greater the likelihood of injury. Placing one's feet close together while in the crouched position and not lying flat on the ground are crucial in reducing the likelihood of injury from a step voltage or ground current.

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Mechanisms of Injury



- Blunt injury is the fifth mechanism for lightning-strike injuries. Lightning current can cause violent muscular contractions that throw its victims many meters from the strike point.

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Safe Places



- The primary choice for a safe structure is any fully enclosed, substantial building. Ideally, the building should have plumbing, electric wiring, and telephone service. The lightning current is more likely to follow these pathways to ground, which aids in electrically grounding the structure.

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Safe Places




- If a substantial building is not available, a fully enclosed vehicle with a metal roof and the windows completely closed is a reasonable alternative. It is not the rubber tires that make the vehicle safe but the metal enclosure that guides the lightning current around the passengers, rather than through them. Do not touch any part of the metal framework while inside the vehicle.

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Safe Places




- Convertible vehicles and golf carts do not provide a high level of protection and cannot be considered safe from lightning.

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Unsafe Places




- Unfortunately, those properties that serve to define a safe structure and improve the safety of its inhabitants also present a potential risk. Lightning current can enter a building via the electric or telephone wiring. It can also enter via a ground current through the incoming plumbing pipelines.

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Unsafe Places



- This condition makes locker-room shower areas, swimming pools (indoor and outdoor), telephones, and electric appliances unsafe during thunderstorms because of the possible contact with current carrying conduction.

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Unsafe Places



- Small structures, such as rain or picnic shelters or athletic storage sheds, are generally not properly protected and should be avoided during thunderstorms. This includes dugouts and sheds. These locations may actually increase the risk of lightning strike via a side flash and cause injury to the occupants.

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Lightning Entering a Building



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Lightning Entering a Building



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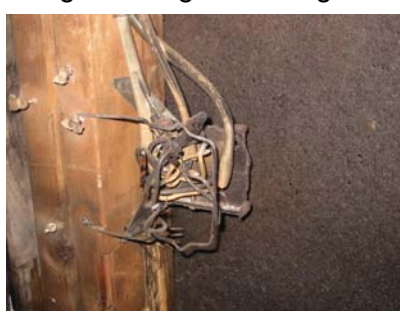
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Lightning Entering a Building 




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What to do... 

- The flash-to-bang method is the easiest and most convenient means for determining the distance to a lightning flash and can also be used to determine when to suspend or postpone activities.


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What to do.... 

- The flash-to-bang method is based on the fact that light travels faster than sound, which travels at a speed of approximately 1.61 km (1 mile) every 5 seconds. To use the flash-to-bang method, begin counting on the lightning flash, and stop counting when the associated clap of thunder is heard.

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What to do....



- Divide the time to thunder (in seconds) by 5 to determine the distance (in miles) to the lightning flash. For example, an observer obtains a count of 30 seconds from the time he or she spots the flash to when the thunder is heard. Thirty divided by 5 equals 6; therefore, that lightning flash was 6 miles (9.66 km) from the observer.

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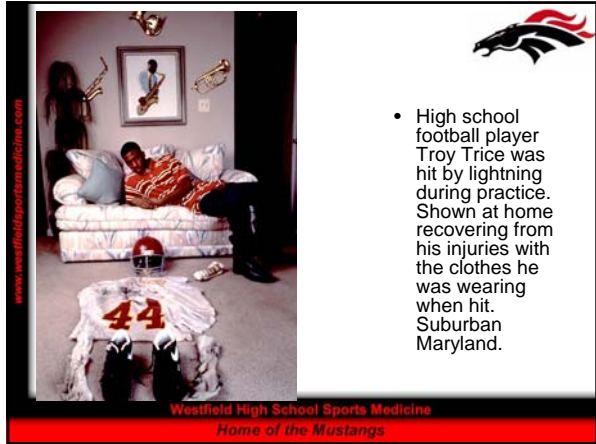
Spring ISD Weather Plan



- Any detected lightning within 8 miles is a mandatory removal from practice/game fields. (Flashes 3-8 on lighting detector)
- A fifteen minute wait is mandatory also from the last strike within the 8 mile range.
- The fifteen minute clock begins AGAIN after each lightning strike within this 8 mile range (40 Seconds – Flash to bang).
- Use common sense in determining if the weather is safe for returning to practice or game. If the weather looks dangerous, then wait beyond the fifteen minutes until the weather clears.

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- High school football player Troy Trice was hit by lightning during practice. Shown at home recovering from his injuries with the clothes he was wearing when hit. Suburban Maryland.
