Losing Your Cool

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WITH THE SUMMER HEAT just around the corner, it's a good time to look at the condition known as hyperthermia—a raising of the body's core temperature as a result of the body's inability to shed heat.

When it comes to heat-related illness, the human body can be compared to a water-cooled motorcycle traveling in hot weather. If there isn't enough water in the radiator (or even if there is but the bike is climbing a very steep hill), there is a potential for overheating. The extent of the overheating and resulting damage suffered by the motorcycle will vary according to factors such as the age and condition of the bike, how long the overheating condition was present, and how the overheating was corrected. (We've all heard horror stories about pouring cold water into a hot dry radiator.)

Heat-related illnesses are very serious yet almost always preventable. Knowing the cause, prevention, and treatment of hyperthermia will enable you to avoid a potentially dangerous condition during hot weather riding.

Heat Production and Regulation

The body basically acts as a furnace, producing heat through chemical reactions and activities. Most of the heat produced in our bodies in generated in our skeletal muscles and deep organs, in particular the liver, brain, and heart. These organs and muscles are contained in a hypothetical region referred to as the core. Heat is constantly being produced at the core and transferred to the skin where it is lost to the environment. If you were unable to shed the heat your body produced, your core temperature would increase by about 2°F per hour in hot weather.

Normally our core temperature is regulated by an internal thermostat located at the base of the brain in the hypothalamus. This thermostat is referred to as the temperature regulating center, and it contains a large number of heat- and cold-sensitive neurons. If blood temperature is below normal, cold-sensitive neurons send signals to start additional heat-producing mechanisms such as shivering. If the blood flowing through the temperature regulating center is above normal, heat-sensitive neurons initiate impulses to start heat-loss mechanisms. Heat is shed from the body via the four mechanisms listed in Table 1.

Some of the main mechanisms by which the body loses heat are by increasing the amount of blood shunted to the skin's surface (vasodilation); sweating, which cools the body via evaporation; and by decreasing activity which decreases heat production. Table 1 tells us that the body loses the majority of its heat through radiation and evaporation. Once the air temperature reaches or exceeds 95°F, the body no longer loses heat through radiation.

At this point evaporation of sweat becomes the only means of heat loss. Since sweating is limited by your fluid level, clearly you must drink enough fluids when riding in hot weather. When the humidity is very high, say 95%, little if any evaporation takes place and riding becomes very dangerous.

Humidity plays an important role in how hot a temperature feels. Just as cold weather is affected by the wind chill factor, warm weather is affected by the heat index. Table 2 shows that a 90°F day will feel like 85°F if the humidity is only 10%, but it will feel like 113°F if the humidity is at 80%.

Heat-Related Illness

Hyperthermia is elevated core temperatures due to the inability to dissipate the body's heat. You have probably heard the terms "heat exhaustion" and "heat stroke." It's important to know the difference and the treatment of both.

Heat Exhaustion

The most common of the heat illnesses is heat exhaustion, which occurs as a result of excessive sweating without replacement of the lost fluids. Eventually the body's cooling system doesn't have enough water left to keep its core temperature in the normal range. It literally becomes exhausted trying to dissipate the excess heat. A temperature between 102°F and 104°F is indicative of heat exhaustion.

Heat exhaustion can be compared to a motorcycle engine whose radiator is low on water—the engine overheats. Adding water will almost always solve the problem. If you've ever been riding in the heat and suddenly felt tired, weak, anxious, and nauseous, you were suffering from heat exhaustion (see Table 3).

Heat Stroke

When the body's core temperature reaches 105°F or higher, this condition is known as heat stroke. A person suffering from heat stroke is experiencing a life-threatening illness and could die within minutes if not properly treated. There are two types of heat stroke—fluid depleted and fluid intact. Both are equally serious.

Fluid-depleted heat stroke occurs when a person suffering from heat exhaustion continues to function without treatment in a heat-challenged situation. This type of heat stroke is like an engine whose radiator has gone dry. The victim has no water left for evaporative cooling and the result is a rapid rise in core temperature. In addition to all the symptoms of heat exhaustion (Table 3), a victim of heat stroke will almost always have a sudden onset of bizarre behavior such as hallucinations, confusion, disorientation, and coma. Left untreated this person will suffer permanent brain damage and will probable die within a couple of hours.

The key factors in identifying fluid-depleted heat stroke are a victim whose skin is very hot to the touch but there is an absence of sweating. If these two factors are present, this is a life-threatening condition. Call 911 and begin treatment immediately.

Fluid-intact heat stroke occurs when the body is producing heat faster than it can lose it, even though the person's fluid level is sufficient. For example, suppose your bike quit running in the middle of the desert on a hot day and you decided to push it to the next exit a half mile away. Even a well-hydrated individual could suffer from heat stroke under such conditions. The body's heat loss mechanisms become overwhelmed by heavy exertion in a hot environment. The key factors in identifying fluid-intact heat stroke are a victim whose skin is very hot to the touch, but unlike the fluid-depleted victim, profuse sweating may be present.

When the temperature is 95°F or higher and the relative humidity is high, this is your signal to be vigilant in watching for signs of heat-related illness in yourself and others in your group. Even if the humidity isn't high, when it's hot take frequent breaks and drink plenty of cool water—even if you're not thirsty. Soda, coffee tea, and alcohol are diuretics—they increase urination and ultimately hasten dehydration.

For those of you that like to ride in T-shirts and shorts in the hot weather—don't do it. It's a bad idea for a lot of reasons, one of which is it speeds up the lose of body fluids through evaporation of sweat at a much faster rate than if you left your leather jacket and long pants on. The best thing to do is to bring extra water for keeping your clothing wet. This allows for evaporative cooling without losing body fluids in the form of sweat.

Treatment

It's a good idea to add an oral thermometer to your first aid kit during the summer. It's the only sure way of diagnosing heat illness and will be invaluable in monitoring a victim's recovery.

Heat Exhaustion

If you suspect heat exhaustion, either in yourself or another member of your group, get the victim out of direct sunlight, preferably into an air-conditioned environment. If he feels dizzy, have him lie flat and elevate his legs. Give

Table 1: Four Mechanisms of Heat Loss from the Body

Conductive heat loss occurs when a warmer object comes in direct contact with a cooler one. Sitting in an air-conditioned restaurant in a booth that's covered in vinyl while wearing shorts and a tank top is a good way to lose heat via conduction.

Convective heat loss occurs as cooler air or water circulates past a warmer object. Standing in front of a blowing air conditioner is a good way to lose heat by convection. If you're riding in air temperature that exceeds body temperature, the body actually gains heat energy through convection.

Radiant heat loss occurs because of the temperature difference between our bodies and the environment around us. It accounts for the majority of heat dissipation. If the surrounding air temperature is less than body temperature, approximately 65% of the body's heat is lost by radiation.

Evaporative heat loss is the transfer of heat by transformation of a liquid (sweat, for example) into a gaseous phase (into the air). It accounts for approximately 30% of the body's heat loss.

Table 4: Water Content of Common Fruits

Fruit	*Percent Water*
Apple	84
Apricot	87
Avocado	81
Blueberry	80
Banana	76
Grapefruit	90
Grapes	83
Watermelon	93
Orange	87
Papaya	91
Peach	89
Pear	86
Pineapple	84
Plum	84
Strawberry	91

small amounts of cool liquids, preferably water, every few minutes. The victim may feel too sick to drink, but he must.

Remove any heat-retaining clothing such as leathers and place a wet bandanna on the person's forehead, top of the head, or back of the neck. If you've got a good water supply, wet the victim's clothing and fan him to increase evaporation. Once the person's core temperature returns to a normal level and he has replenished his fluid supply, he will probably feel fine.

Heat Stroke

The treatment of heat stroke begins with aggressive cooling measures. Get the victim out of the sun and remove his clothing. If possible, immerse the person in cool water. If immersion is not possible, pour water over his body and fan him to increase evaporation.

Because heat stroke causes major organs to shut down and typically causes nausea and vomiting, a person suffering from heat stroke will not be able to absorb ingested water fast enough to do any good. Just as it isn't advisable to pour water into a bone-dry radiator until it's cooled down, you should not give water to a person suffering from heat stroke until you've gotten his core temperature down to an acceptable level (around 102°F.)

Once the temperature has been reduced, stop aggressive cooling—it can cause shivering and actually increase the core temperature. Now is the time to get liquids into the victim regardless.

It is very important to take a person who has suffered from heat stroke to a medical facility even if it appears that the victim has made a full recovery. His temperature-regulating mechanisms may not be working properly and he could soon be in danger again.

Prevention

Prevention is the real key to heat-related illnesses, and water is the key to prevention. A late sign of dehydration is thirst. Once you feel thirsty, you're already low on fluids. The best indicator of proper fluid levels is urine output and color. A small amount of dark-colored urine isn't a good sign. Dark urine is concentrated which means your body is low on water and is trying to conserve its supply. Strive for large amounts of light-colored urine.

Water comprises 50–70 percent of our body weight. An average adult needs about 64 ounces (eight cups) of water a day. Most of us don't drink that much water, but get most of this water requirement from other types of liquids and the foods we eat. Fruits are a particularly good source of water (see Table 4) which makes them an excellent snack choice when riding in the heat.

Snacks or meals that are high in fat and protein (chips, hamburger, fries) produce a lot of metabolic heat during digestion and should be avoided when riding in the heat. Also, the more body fat you have, the less water you carry. Because males tend to have less body fat than females, they naturally have a higher percentage of body water and are less at risk for heat illness. FZ

Table 3: Symptoms of Heat Exhaustion

- Cool clammy skin
- Sweating (may be profuse)
- Fatigue
- Dizziness
- Thirst
- Nausea
- Vomiting
- Anxious
- Elevated temperature

Keep Yourself Cool!

Table 2: The Heat Index

Relative Humidity	Ambient Air Temperature (°F) Feels like										
	70	75	80	85	90	95	100	105	110	115	120
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	130
30%	67	73	78	84	90	96	104	113	123	135	148
40%	68	74	79	86	93	101	110	123	137	151	
50%	69	75	81	88	96	107	120	135	150		
60%	70	76	82	90	100	114	132	149			
70%	70	77	85	93	106	124	144				
80%	71	78	86	97	113	136					
90%	71	79	88	102	122						
100%	72	80	91	108							

90–104 degrees	Heat exhaustion possible
105–130 degrees	Heat exhaustion likely; heat stroke possible
130 degrees and up	Heat stroke very likely