



# THE TACTICAL EDGE

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# *Hyperthermia and Heat Illness*

## *Considerations in Hot Weather Special Operations*

*by Lawrence Heiskell, M.D.*

### **Introduction**

**I**n the hot, dry valley of Central California, a SWAT Team Leader lolls under the shade of a tree during a planned rest period while on a routine tactical training exercise. He is draining the last drop of his fifth canteen of water. Temperatures will probably reach 105. He is hot, but neither he nor his team members have suffered any heat illness, nor will they. Virtually all heat injuries are preventable if appropriate measures are taken in advance.

Heat-related illness is common during the hot, humid months of summer, and tactical teams that train and conduct special operations are not exempt. The medical disorders related to environmental heat exposure are exceptionally common in persons who perform hard work in hot climates. They also occur in competitive athletes as well as in individuals engaged in military and law enforcement training exercises.

Heat-related illnesses may be as minor and self-limiting as the swelling of the feet and hands, or as life-threatening as a medical emergency as true heatstroke. Proper education of tactical team members is essential to reduce the incidence of heat illnesses.

Man's survival depends upon maintaining the body temperature within a narrow range. This is critical for optimal functioning of organ systems that regulate essentially all

cognitive, physiologic and biochemical processes that determine our day-to-day well being. To sustain the body temperature within close proximity to 37 degrees C (98.6 F), it is necessary to maintain a fine balance between heat loss and heat gain.

Three factors determine the thermal balance of the body: metabolic

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heat production, heat exchange between the body and its surrounding, and heat loss by the evaporation of sweat. It is when thermoregulation mechanisms fail, that a number of important heat stress syndromes may appear.

The most important factor that complicates thermoregulation is humidity. The rate of heat loss from the skin is directly related to the rate of evaporation. As the humidity rises, sweat evaporates much more slowly. The rate of heat loss is drastically reduced, and when the humidity is above 75%, evaporation effectively ceases. This is an especially important consideration for tactical teams that operate in areas

of the country with hot, humid weather.

### **Heat Production**

Under normal conditions, the thermoregulatory center in the brain responds to the temperature of blood as it passes through the brain. It then initiates the physiologic responses necessary to maintain a setpoint of 37 degrees C (98.6 F). Our metabolism and the environment combine to create heat in the body. At rest with normal activity we produce heat at a rate of 1.1 degree C/hour. However, with exertion, this rate can be increased by twelve fold. Heat illness occurs when the body is unable to compensate for excesses in heat generation, which can be external or internal. If the body did not have some mechanism for cooling, the intrinsic heat generation would continue to rise unabated, which would be obviously inconsistent and incompatible with life.

Simple logic tells us that when the air temperature exceeds body temperature, we accumulate heat.

### **Environmental Factors**

Heat and humidity are environmental factors that are important causes of heat illness. The environmental heat load is very important in areas with combined high heat and humidity, such as the southern part of the United States, which has a much higher incidence of heat illness than do areas with dry desert heat, such as the western part of the

country. Cities have a higher incidence of heat illness than do rural areas, since the radiant heat load from streets and buildings is greater and prevents temperatures from dropping at night as they do in the country.

Individual characteristics also predispose an individual to heat illness. Persons vary widely in their sensitivity to this disease.

These individuals are often involved in physical tasks to which they may or may not be accustomed. The combination of the increased physical activity with hot environmental conditions may stress even young, healthy individuals, especially when they are not acclimatized to the heat.

As tactical officers, we consider ourselves athletes, and unfortunately athletes are vulnerable to heat illness.

Although the mortality from heat illness in the general population is very small when compared with major disease, heat illness is second only to head and spine injuries as a cause among young athletes in the United States. More than one thousand cases of heat exhaustion in U.S. athletes are reported each year.

### **Heat Cramps**

Heat cramps typically affect muscles that have been stressed by heavy exertion. The victims tend to be young and otherwise healthy individuals who sweat copiously and then drink water without a compensatory salt intake. They are easily treated with cooling and replacement of the victim's lost salt and fluids. Sodium Chloride (salt tablets) 1 gram can be given every 1-3 hours until the symptoms subside.

### **Heat Exhaustion**

Heat exhaustion, also known as heat collapse or heat prostration, is an ill-defined syndrome that can occur in any individual. Its symptoms are nonspecific and can include headache, nausea, vomiting, thirst and muscle cramps. Typically, the body has been forced to work too hard to keep its body temperature down. So much fluid has been lost through perspiration that the delicate balance of the body functions has been affected.

### **What to Watch for in the Field**

- Rapid pulse
- Increased respirations

- Skin may be flushed, clammy or sweating
- Temperature is normal or moderately elevated, but below 40 degrees C (105 F)
- Mental function essentially intact

### **Treatment of Heat Exhaustion**

- Allow the victim to rest
- Reduce the heat challenge by placing the victim in a cool, shady area
- Fluid replacement by mouth if the victim is not vomiting

### **Heatstroke**

Heatstroke is a less common but more serious illness caused by heat

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***“The key to the prevention of heat illness is to consume as much water as the body is losing.”***

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exposure. This is the result of the body's core temperature reaching dangerous levels when the body is exposed and subjected to more heat than it can handle.

Heatstroke accounts for about 5,000 deaths a year in the United States. Estimates of the mortality rate range from 20% to 70%. A significant number occur in young, healthy persons after overexertion.

As the heat challenge continues, at some point the body loses too much fluid through perspiration and it shuts off sweat to maintain fluid levels. Now the body has lost its best cooling system and is in potentially fatal trouble.

As mentioned previously, heatstroke is the result of the body's core temperature rising to dangerous levels when the body is subjected to more heat than it can handle. This, then, overwhelms the normal mechanisms for getting rid of the excess heat. What you do in the next twenty minutes can save a heatstroke victim's life.

Heatstroke is one of the most dramatic true medical emergencies involving every organ in the body but the pancreas. A debate continues over whether the underlying cause is primarily increased body temperature per se, or the duration of the hyperthermia. Regardless of the pre-

cise mechanism, the end results are essentially the destruction of cell membranes, widespread tissue damage, and global organ dysfunction. The elevated temperature and the runaway destructive process in heatstroke is entirely different from the milder heat exhaustion.

### **What to Watch for in the Field**

- Rapid pulse and respirations
- Elevated temperature, usually above 40 degrees C (104F)
- Confusion, lethargy, agitation
- Hot, dry skin
- Seizures and coma

### **Treatment of Heatstroke**

Victims of heatstroke must be treated aggressively and rapidly. Every minute of delay increases the likelihood of serious complications or death. The first priority is protection of the airway, and this may require endotracheal intubation if the patient is comatose. While the team physician or paramedic is ensuring an adequate airway, intravenous access should be established and cooling measures begun. The most rapid method of cooling heatstroke victims in the field is to undress them completely and spray them with a cool mist and fan them by the best means available to enhance airflow over the body. This very efficient method of cooling reduces the temperature by .03 to .06 degrees C/min. The common practice of placing ice packs on strategic areas of the body, for example the axillae (armpits), groin and neck should be discontinued. This is because ice packs enhance cooling by an average of only 5%, and may be counterproductive because they increase peripheral vasoconstriction and may induce shivering. Immersion in a tub of ice water is effective and reliable but not practical in the field, and electrocardiogram monitoring cannot be continuous while the victim is submerged.

### **Prevention of Heat Illness**

No team member should ever reach the preventable point. If you lose more water than you take in, you will eventually become dehydrated. The key to the prevention of heat illness is to consume as much water as the body is losing. Keep in mind that a 100-man football team during practice easily consumes 150 to 200 gallons of water during a 90-

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# Hyperthermia

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minute training session. Remember that sweat is basically water, and there is very little salt in sweat.

Contrary to the popular myth that the main problem in heat is salt loss, it is in reality water loss.

## Tactical Considerations

While engaged in hot weather special operations, it is important to

keep the following points in mind. Tactical officers on a building rooftop and exposed to bright sunlight can double their heat exposure. Sitting in patrol cars or SWAT vans on hot days, frequently with poor air circulation, increases the levels of radiant heat and places these individuals at high risk to heat illness.

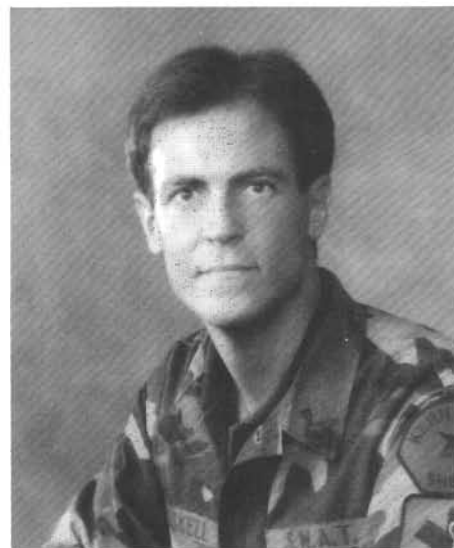
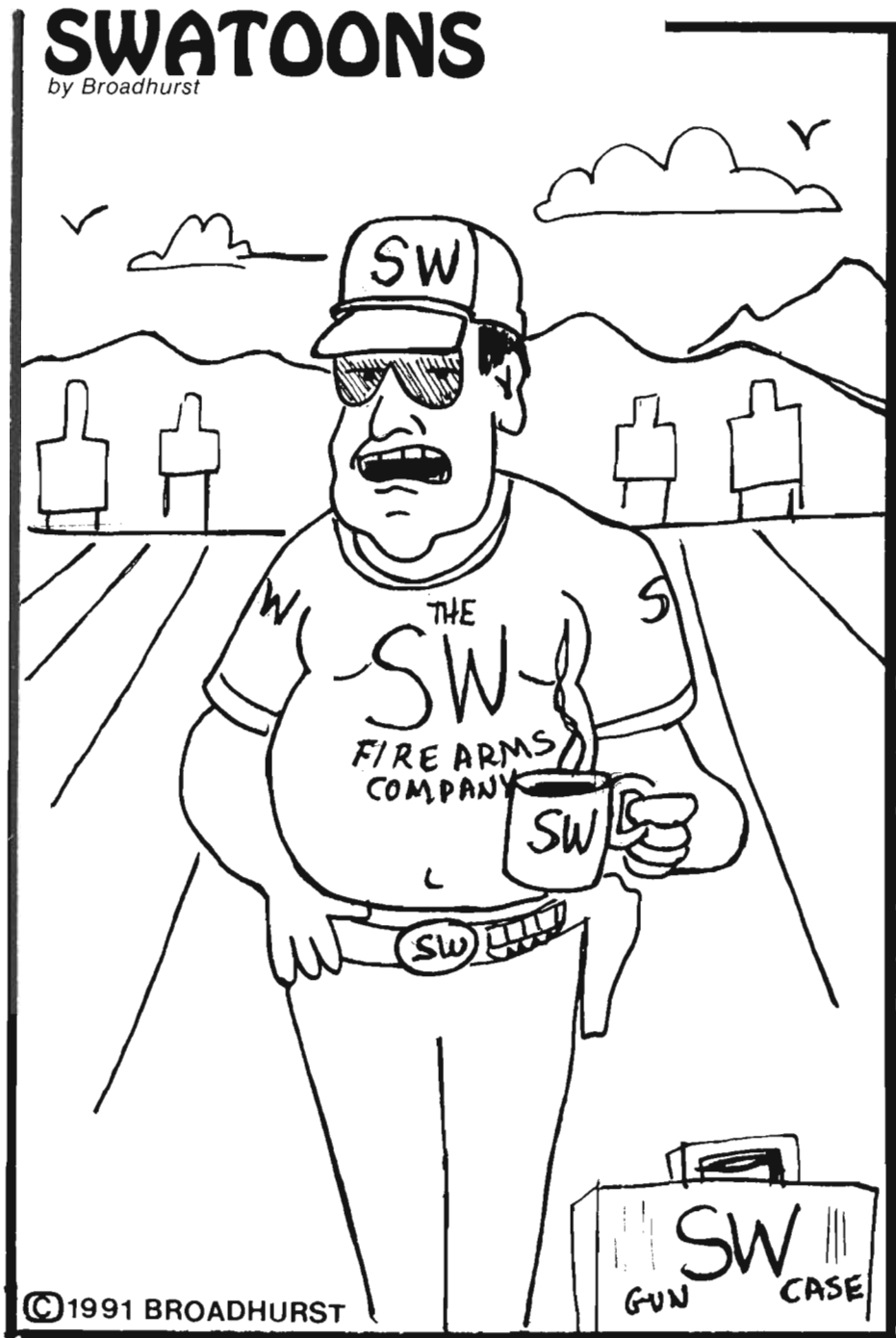
- Drink plenty of cool water
- Wear loose clothing
- Take breaks regularly in the shade

(In the Mideast, the Army enforced work/rest cycles with 10 to 20 minute breaks each hour for soldiers to cool from exertion.)

- Do not take salt tablets
- Eat light meals

(Hot, heavy meals just add heat to your body.)

Remember, virtually all heat injuries are preventable if appropriate measures are taken in advance.



### About the Author

Lawrence Heiskell is a senior emergency medicine resident in the Department of Emergency Medicine, Kern Medical Center, Bakersfield, California. Doctor Heiskell completed a surgical internship at the University of Maryland, and is residency-trained, board-certified in Family Practice. Doctor Heiskell is a peace officer in the State of California and holds a commission of Reserve Deputy Sheriff with the Kern County Sheriff's Department. He is SWAT trained, a graduate of the American Pistol Institute, and an H&K certified MP5 Instructor. He is currently assigned to the Special Weapons and Tactics unit as the team physician.

"WE ON THE NEW WEAPON SELECTION COMMITTEE HAVE NOT DECIDED WHICH MANUFACTURER WE WILL BE GOING WITH, BUT A DECISION IS DUE SOON!"