THE TACTICAL EDGE

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Hypothermia and Frostbite: Considerations in Cold Weather Special Operations

by Lawrence E. Heiskell, M.D.

Introduction

As we approach the winter months, tactical units will face another enemy. This one is the killer of the unprepared. During the winter of 1812-1813, Napoleon's Army suffered great losses not from battle injuries but from frostbite and hypothermia, during the retreat from Moscow. Dominique Jean Larrey, the army's surgeon in chief, witnessed the horrendous loss of limb and life from wet gangrene. Larrey observed the effects of the freeze-thaw-freeze cycle, as his patients froze on the march, then thawed in front of a fire at night, and refroze while on the march the next day. Similar catastrophic results were repeated by British troops in the trenches of World War I, the German army on the Russian front and American GI's in the Korean War.

Frostbite

Frostbite occurs when tissue freezes. The nose, ears, cheeks, and the distal extremities, (i.e., fingers and toes) are the most commonly affected body parts. However, any external part of the body or portion of the skin may be affected. Predisposing factors include the amount of tissue exposed, nutritional status, ambient temperature, wind, humidity, previous cold injury, physical activity, and tight clothing or boots. Perhaps the most dramatic cases of frostbite occurred during World War II among the waist port gunners on B-17 and B-24 bombers. The gunners had to open the doors to fire their machine guns and were exposed to super cold air rushing by at over 200 miles per hour. During the winter of 1943, frostbite caused more casualties in these bomber crews than all other sources combined.

Wind Chill

Our bodies continually produce and lose heat. Wind increases your body's heat loss by dispersing layers of warm air trapped between layers of clothing and skin. This heat loss increases as the wind speed goes up. At low temperatures, frostbite can occur any time the wind removes body heat faster than the body can replace it. Thus, either a drop in the ambient temperature or a rise in wind velocity can increase the danger of frostbite. The wind chill chart in Figure 1 shows the combined effect of wind and temperature in terms of an equivalent effective temperature acting upon exposed skin. It is astonishing but true that an ambient temperature of 20 degrees Fahrenheit combined with a 40 mph wind is identical to that of a minus 21 degree Fahrenheit temperature.

WIND-CHILL CHART

Estimated Wind Speed MPH	ACTUAL THERMOMETER READING °F.											
	50	40	30	20	10	0	—10	—20	—30	—40	—50	—60
	EQUIVALENT TEMPERATURE °F.											
Calm	50	40	30	20	10	0	—10	—20	—30	—40	—50	—60
5	48	37	27	16	6	—5	—15	—26	—36	—47	—57	—68
10	40	28	16	4	—9	—21	—33	—46	—58	—70	—83	—95
15	36	22	9	—5	—18	—36	—45	—58	—72	—85	—99	—112
20	32	18	4	—10	—25	—39	—53	—67	—82	—96	—110	—124
25	50	16	0	—15	—29	—44	—59	—74	—88	—104	—118	—133
30	28	13	—2	—18	—33	—48	—63	—79	—94	—109	—125	—140
35	27	11	—4	—20	—35	—49	—67	—82	—98	—113	—129	—145
40	26	10	—6	—21	—37	—53	—69	—85	—100	—116	—132	—148
Wind speeds greater than 40 MPH have little additional effect	LITTLE DANGER FOR PROPERLY CLOTHED PERSON				INCREASING DANGER			GREAT DANGER				
	DANGER FROM FREEZING OF EXPOSED FLESH											

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infection sets in.

Hypothermia

Hypothermia is defined as a lowering of the core body temperature less than 35 degrees centigrade (95° Fahrenheit). When the human body loses more heat than it is producing, there is a danger of hypothermia. The human body can tolerate a drop of only a few degrees of internal body temperature. As the core temperature falls, organs such as the brain, heart, lungs and other vital organs slow down, and survival becomes threatened. If no action is taken to reverse this process, death will ultimately result. Normal body temperature is maintained by metabolism and muscular activity, both of which are dependent on energy supplied by food and fluid intake. The lack of sufficient food and water, combined with overexertion, diminish the body's ability to produce body heat. Wearing inadequate clothing in wet, windy or cold weather conditions accelerates the body's heat loss.

Heat Loss

Body temperature may fall as a result of heat loss by one of four mechanisms. These are known as conduction, convection, evaporation, and radiation. Conduction is the transfer of heat by direct contact down a temperature gradient, for example, from a warm body to the cold environment. Since the thermal conductivity of water is approximately 30 times that of air, the body loses heat very rapidly when wet, leading to a rapid decrease in body temperature. Convection is the transfer of heat by the actual movement of heated material, for example, the wind disrupting and removing the layer of warm air surrounding the body. Convection heat loss increases considerably in windy conditions. Evaporation is the loss of heat through sweat from the skin and as we breathe air.

Radiation is the leading cause of heat loss in almost any situation, and the head is the most efficient portion of the body's radiator system. So rapid is the radiation of heat from the head in cold environments that heat loss from an unprotected, uncovered head can be enormous. An unprotected head may lose up to one-half of the body's total heat production at 40 degrees Fahrenheit. Remember, when your feet are cold, put your hat on. Balaclavas are essential for protection against this dramatic heat loss in cold, windy and wet situations.

Signs and Symptoms of Hypothermia

The hypothermia victim initially is exhausted, lags behind, stumbles, is not mentally sharp, and is sometimes reluctant to move on. However, at the same time, the victim may be difficult to convince that there is something wrong, because the symptoms of hypothermia are frequently mistaken for simple fatigue. People have died of hypothermia without even complaining of the cold. It is imperative that hypothermia be recognized and treated quickly. Remember that in a tactical situation, the whole team may be affected by hypothermia in various stages, making it more difficult for everyone to recognize the symptoms.

What to Watch for While Working in the Field

- Pale and cool skin
- Excessive urination
- (LETHARGY) Weariness and reluctance to continue moving
- Trembling and shivering
- Changes in personality
- Clumsiness and loss of problem-solving ability and judgment

These symptoms precede collapse and unconsciousness. Catch them before your situation gets critical.

Treatment of Hypothermia

- Change the environment. Provide shelter for the victim by removing him from wetness and wind,thus reducing the cold challenge.
- Retain heat. Place as much insulation as you can between the victim and the ground. Place the victim in a sleeping bag with warm, dry clothing.
- Add heat. Attempt to actively rewarm the victim by methods such as drinking warm liquids, sun warming, place near a fire or warm bodies.

Prevention of Hypothermia and Frostbite

- Know your enemy, cold can be subtle and diabolical. Never underestimate its insidious power, nor overestimate the strength of yourself or your fellow teammates.
- Dress for warmth, wind and wetness. Wear peelable layers of clothing to retain a layer of warmed air close to the body.
- Fatigue, wet clothing, increasing wind speed, inactivity and the lack of adequate energy resources accelerate hypothermia. Good physical condition, a proper amount of nutritional intake, and adequate clothing all help to prevent hypothermia.

Tactical Considerations

In order to carry out effective cold weather special operations, effective clothing is essential. It is also the responsibility of the team commander and team leaders to ensure that each member involved in the operation is properly dressed. Imagine if the sniper missed his shot because his hands and fingers were too cold for adequate trigger control. If an entry team is delayed in position for 30 minutes, the members could have reduced dexterity because of shivering, increased irritability, and may have a decrease in judgment and problem-solving ability, all of which are the result of hypothermia.

For Your Information

Memorial Fund

The National Tactical Officers Association would like to thank the following individuals and groups for their thoughtful donations to the Memorial Fund:

Tactical Response Team, Munster (IN) P.D.	$125.00
T/Sgt. Grant D. Graham, Sr., USAF	$10.00
F. Scott Hayes, Salem (OR) P.D.	$25.00

Any member or group interested in making a donation to the fund should direct their contributions to the N.T.O.A. Memorial Fund, P. O. Box 1412, La Mirada, CA 90637-1412.

All recommendations for awards should be made by mail to N.T.O.A. headquarters, or in extreme cases, by calling N.T.O.A. at (310) 943-4223.

Ambient Temperature and Climatic Factors

Ambient temperature, humidity, wind and the duration of exposure influence the extent of a cold injury. Decreased temperature, increased winds, increased humidity and increased duration of exposure result in a greater risk of cold injury. The only warning symptoms may be a stinging or tingling in the affected part, followed by numbness. If the frostbite is superficial, the frozen part, though obviously white and frozen on the exterior, will be soft and resilient below the surface of the skin. If deep freezing has occurred, the tissue will appear white and will have a hard or brittle feel, with a complete lack of sensation or movement. Early detection of frostbite will minimize tissue damage. As soon as your face, feet, or hands become so cold that they stop hurting, you should seek immediate treatment from your team paramedic or physician.

Prevention of Cold Injury

To prevent frostbite of the face, always wear some type of hood or balaclava. Take particular care not to let your gloves, shoes or hands get wet with gasoline, alcohol, fuel oil, or any liquid that freezes, because wetting speeds up heat loss and increases the risk of frostbite. Be careful not to touch cold metal or other objects with bare skin, because skin that comes into contact with a cold object may stick to it and freeze, becoming instantly cemented to the cold metal with skin being torn off when the hand is removed. Team members should employ the "buddy system" and periodically check each other for telltale white spots on their exposed skin.

Treatment of Frostbite

Treatment begins with field rewarming at the first sign of numbness. Any method of rewarming may be used as long as it does not cause burns or tissue damage. The easiest and most practical techniques for rewarming is skin-to-skin contact. Frostbitten fingers are best treated by wearing a parka with large armholes that permit the arms to be drawn up inside the parka and the hands warmed under the opposite armpits. If the parka sleeves are too small, tuck your hands into your pants. Frostbitten feet are best thawed under the warm clothes of a team member.

In all cases of cold injury, one should make every effort to transport the patient to a location where medical facilities are available. Slow and inadequate rewarming of the frozen part, especially if followed by refreezing, invariably results in a severe injury. Never thaw a frostbitten limb in the field unless it can be maintained at temperatures above freezing.

Optimally, the frozen part should be thawed by placing it in a container of water at temperatures of 40 to 42 degrees centigrade (108° to 110° Fahrenheit) for approximately 30 minutes, or until the frozen part is red in color. Follow-up treatment under a physician's care is essential. When minor frostbite occurs, team members should see their team physician, because even minor frostbite problems can become serious if

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Effective insulation and retention of body heat is the key to staying warm. Insulation largely is determined by the combined thickness of all garments worn and the spaces between them.

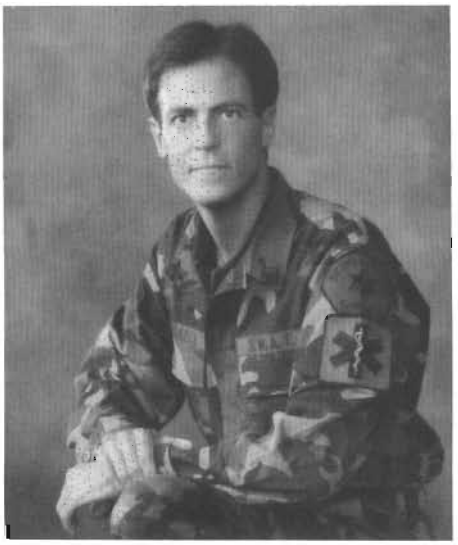
The most important layer of clothing is the outer layer. It should repel wind, yet allow the escape of body moisture. Sweating is dangerous, because it leads to freezing. If an operation leads to exertion and overheating, then a layer or two of clothing should be removed or opened to provide ventilation.

A number of medium-weight garments worn in layers can easily be adjusted to all weather conditions. Avoid heavy and bulky clothing, which makes you prone to accidents from lack of agility and visibility.

Boots should not fit too tightly by wearing too many socks. When more than one pair of socks are worn, the socks must increase progressively in size from inner to outer layer to prevent constriction or pressure on the feet. Keep ears covered, protect cheeks and nose by wearing your balaclava.

Once in position, if rotating of officers is not possible, the most effective and efficient method for heat production are isometric contractions of successive muscle groups until the desired warmth is produced. With these points in mind, tactical teams that operate in cold weather conditions should be able to perform special operations effectively, efficiently and safely.

About the Author



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