

## Immersion Hypothermia

### **Cold, Wet and Up to your Neck**

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As a group, divers are better informed on the subject of hypothermia than is the general public, or, at least, we like to think so. In reality, however, all most of us really remember from our basic training is that when a diver starts to shiver uncontrollably, then it's time to get out of the water. Certainly this is good advice as uncontrollable shivering signals the onset of mild hypothermia and, even more importantly, the victim's condition may deteriorate very rapidly after this stage. So suppose we get out of the water, mildly hypothermic. Then what do we do? Jump into a bath of hot water? Or what about the more severely hypothermic victim? How do we recognize his condition? And far from medical help, what's the best field treatment? To answer these questions we need to back up and review what hypothermia is, how we get that way, and what we can do about it on the dive site.

### **Hypothermia and the Diver**

Hypothermia is defined as a drop in the body's core temperature, the core being the spaces occupied by the major organs, heart and principal blood vessels. This condition may come about anytime the body loses heat faster than it can be generated. Of course, the onset of hypothermia is not typically instantaneous. How long it takes to become hypothermic depends on the rate of heat loss. Immersion in water of even 80 deg. F will result in hypothermia eventually, if we have no environmental exposure suit on. In colder waters, the rate of heat loss is much greater. Basically, we will always lose heat to the environment when the ambient temperature is less than body temperature.

Normally we lose heat by conduction (warming of the air or water around us through direct contact), by convection (wicking away of heat by moving air or water), by radiation (emitting infrared heat waves), and by evaporation (sweating and exhaling warm, moist air). Wearing a wet or dry suit goes a long way toward reducing heat loss by establishing a neoprene or enclosed air barrier between the body and the environment. This does not eliminate heat loss, it just gives us a longer time in which to work effectively. As well, the suit does nothing to diminish heat loss through the exhaled breath, a particular problem for the mixed gas diver whose breathing mixture may contain high heat-transfer gases. In any case, all divers breathe exceedingly dry gas, and the drier the gas, the more water vapor will dissolve in it. The more water evaporates, the greater will be the heat loss.

For our purposes we can consider this net loss in heat production to begin as soon as we enter the water. Immersed in cold water, our (unprotected) body reacts quickly to decrease heat loss and to increase heat production. Control of heat loss is accomplished as the body decreases the amount of blood circulating through the skin (to diminish heat loss through conduction/convection), followed by decreasing the blood flow to the ex-tremities (finger, hands, feet, ears, etc.) for the same reason. Increased heat production is achieved by elevated levels of voluntary activities, more 'energy' chemicals being circulated in the blood, and, especially, by shivering. Shivering alone can raise the heat production a surprising 600% compared to a resting body.

Despite these defenses, the body soon begins to lose the battle to stay warm. By the time the core temperature has dropped below 94 deg.F (moderate hypothermia), the victim, though still conscious, will show signs of foggy thinking, some speech impairment, and inability to use the hands to grasp. below 90 deg.F core temperature (severe hypothermia), the victim may be unconscious, will have severely impaired mental ability, and the skin may be blue (cyanotic) and feel very cold to the touch. Typically, the pulse is irregular and uneven, as well. If cooling continues, breathing and pulse will continue their decline until they are undetectable. Eventually death results from cardiac arrest.

### **Field Treatment for Hypothermia**

On the dive site we might be presented with a victim who may demonstrate any of the above signs, with one very important addition. Unless there is clear evidence to the contrary, we should always make the assumption that an unconscious, non-breathing diver is a drowning victim as well. Our role in assisting a hypothermic diver depends almost entirely on how deeply chilled the victim is on recovery from the water. Since it's unlikely that we'll have access to the highly sophisticated medical monitoring equipment found in an Emergency Room, we'll use the level of consciousness of the diver as our guide to the extent of hypothermia present. Whatever the extent of hypothermia, however, remember that re-warming must always be gradual and from 'the inside out'. Radical measures such as putting the victim in a hot shower or bath will cause an even greater drop in his core temperature. This is because the skin is tricked into thinking that the 'cold crisis' is passed and signals the brain to begin recirculating the super-chilled blood in the extremities. This cold, acidic blood returns directly to the heart and may very rapidly result in cardiac arrest. Many 'rescued' victims have died from the phenomenon, known as 'after-drop'.

#### **Mild hypothermia:**

victim shivering violently, teeth chattering, etc., but fully conscious and alert. If the victim can be brought to a warm environment, remove wet clothing, keep the victim active, and give him warm, sweet drinks. No alcohol! If victim cannot be immediately moved out of a cold environment, it may be best not to remove all clothing at once. For example, remove the wet suit top and replace with a heavy sweat shirt

and warm hat while insulating the victim with blankets. As the victim re-warms through activity and warm drinks, the farmer john may be removed and replaced.

**Moderate hypothermia:**

victim somewhat confused, speech impaired, but conscious. Immediate treatment is to prevent further heat loss and to re-warm victim slowly. If the diver can be brought indoors, remove wet/dry suit as above prevent further heat loss by wrapping victim in warm blankets. Slightly more aggressive re-warming may be called for by applying pre-heated towels (e.g. with warm water) to the armpits, head, neck and groin. These are all high heat loss/gain areas of the body. Victim should rest quietly until he re-warms. Moderate activity may then be useful.

If the diver cannot be removed from the cold, he must be fully protected from the environment. This is best done with a 'hypothermia wrap', as follows: spread a tarp, plastic sheet or other wind-proof barrier on the ground or boat deck; follow with a blanket layer, a reflective-foil (Space-Blanket) type layer and then another warm blanket. In the field limited use of chemical heat packs may be helpful, if applied to the high heat loss areas, as above. Position the victim on the prepared bedding and carefully wrap him. Be sure to cover the entire body, including the head (not his face). Keep the victim wrapped until he can be removed to a warm, dry place.

**Severe hypothermia:**

victim may be unconscious, obvious signs of life may be absent. If unconscious, but obviously alive, we will treat victim as above with the additional warning that gentle handling may be critical to his survival. Monitor the victim's air way and vital signs, and prepare for evacuation to medical facilities. Be prepared to support ventilations with Rescue Breathing, and to apply CPR, if necessary. If the victim was removed from the water unconscious and non-breathing, we will assume both hypothermia and drowning, and attempt immediate resuscitation. It's important to begin re-warming efforts during the resuscitation, if possible. Bear in mind that this may be a long process, and that trained medical help is essential.

As a final note, remember that in all cases where the victim experiences respiratory distress, cyanosis (blue tinge to the skin), or cardiac irregularities such as may result from hypothermia or near drowning, the use of pure oxygen is called for. No dive site is a safe scene without an O2 kit and people who know how to use it.

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