

## Cold Injury Scenarios – Discussion

1. The corporal who has dropped into the icy water is not yet suffering hypothermia but is in danger if you do not take immediate, decisive action. Concerning cold water survival, on average a casualty will have to remain in ice water for 30 minutes or longer before sliding into hypothermia. Remaining calm and taking action to prevent drowning (placing his arms on the ice) is the first step in cold water survival. Since you have seen the incident take place you can assume that he has no other injuries. Your first action will be to remove him from the environment and remove the wet clothing to prevent further cooling. Clothing insulates by trapping air which has a low heat capacity. By volume, water has a heat capacity approximately 4000 times that of air, so a relatively small volume of cold water can soak up quite a bit of heat. Water also has a high thermal conductivity which means it can conduct heat away from the body very quickly. Begin by removing his outerwear (parka, windpants, boots) protecting him as much as possible from the wind. The rest of the section will stop, set up the tent and get the stove going. Inside the tent, place an air mattress and continue to remove ALL clothing while using a towel to gently PAT the skin dry (don't rub). Place the casualty inside a sleeping bag. Since he is well fed and rested, he should be able to recover on his own. Keep the casualty at rest and continue to monitor watching for signs of hypothermia. Give sweetened, warm liquids only if the casualty is conscious.

After immersion in cold water, the core temperature will continue to drop, a phenomenon sometimes called afterdrop. The outer layer of the body (skin, subcutaneous fat) is quickly cooled by the water. Over time this cool tissue continues to draw heat away from the core so that you see a decrease in core temperature even though the casualty is no longer in the water. In a healthy, well nourished casualty the body will be able to generate enough heat to recover. Points to remember: normal core body temperature is 37°C (the core consists of your internal organs such as the heart, lungs, liver, kidneys all of which are essential to maintain life). Technically, hypothermia begins when your core temperature drops by 2°C or more below normal. Since it is difficult to measure core temperature accurately in the pre-hospital setting the signs and symptoms of the casualty along with the environment in which he/she was found are used to determine the severity of hypothermia.

2. You have an obvious case of frostbite with this young private. Although you don't know how long the exposure to the cold has been the obvious facts that his fingers are white and waxy, the -15°C temperature and that he cannot move his fingers indicates frostbite. Injuries which might result in significant disability (loss of eyesight, loss of hearing or loss of function in a limb) are serious medical emergencies and need to be brought to definitive medical care. Luckily you're near a road which your casualty can walk to and a vehicle is only 30 minutes away. Your duty is to prevent further injury to the hand and to arrange for immediate transport to a medical facility. Gently wrap the injured hand and fingers with gauze. Do not rub the skin or try to move or reposition the fingers or hand. Pad with battle dressings and splint. Protect the injured hand from the environment by covering with a triangular bandage. **DO NOT ATTEMPT TO REWARM THE INJURY!!!** Sling the injured hand. Go with the casualty to the road and monitor his condition while you wait for the vehicle.

3. This is a case of mild to moderate subacute (or exhaustion) hypothermia and is a medical emergency. This type of hypothermia can occur over a period of time even in relatively mild weather. The casualty has exhausted his energy reserves (not eating), gradually losing body heat and is not able to rewarm on his own. In addition he is dehydrated, the sunken eyes and cheeks indicate this in addition to the observation that he is not eating and drinking on a regular basis. Lack of water impairs the ability of the body to metabolize fat for energy (he will not be able to rewarm himself efficiently). Stumbling and mumbling are classic signs of hypothermia and are indicative of a serious problem (stumbling indicates a loss of gross motor control, mumbling indicates a drop in the level of consciousness). The proper course of action is to remove the casualty from the environment by placing him in a dry sleeping bag. Call for medical evacuation. Do not attempt to rewarm the casualty in the field. Although this is an emergency you have a reasonable amount of time to evacuate the casualty. Handle the casualty with care as a cooled heart can easily go into ventricular fibrillation if the casualty is handled roughly.

4. This scenario is based on the case of Anna Bågenholm who survived immersion in icy water for 80 minutes with her body temperature dropping to 13.7°C. Here is a description of the rescue and resuscitation from Wikipedia.

*She fell headfirst onto a layer of ice on a frozen stream near a waterfall, landing on her back. A hole opened up in the ice and Bågenholm's head and torso were pulled in as meltwater filled her clothes. Her body became trapped under the ice, which was 20 centimetres (7.9 in) thick. When Falkenberg and Næsheim found Bågenholm, only her feet and skis were above the ice.*

*Bågenholm's colleagues made an attempt to free her but failed. At 18:27 local time (CET), seven minutes after she had fallen into the water, they called for help on a mobile phone. Police lieutenant Bård Mikkalsen received the call and put together two rescue teams; one at the top of the mountain and one at the bottom. Mikkalsen also contacted the Bodø rescue team, which was equipped with a Sea King helicopter, but they told him that the helicopter had left to transport a sick child. Mikkalsen was persistent and convinced the dispatcher to turn the helicopter around.*

*Falkenberg and Næsheim held onto Bågenholm's skis as they waited for the rescue teams to arrive. As Bågenholm first struggled in the cold water, she found an air pocket and was able to remain conscious for 40 minutes before becoming a victim of circulatory arrest. Ketil Singstad led the rescue team from the top of the mountain. He skied as fast as he could to Bågenholm's location, where he and his rescue team tried unsuccessfully to pull her out with a rope. They then tried to dig her out, but their snow shovel could not break through the ice. Rescuers from the bottom of the mountain then arrived, bringing with them a pointed gardening shovel. They were able to cut a hole in the ice, and pulled her through at 19:40. Bågenholm had been in the water for 80 minutes when she was rescued.*

*When Bågenholm was pulled out of the water, her pupils were dilated, her blood was not circulating, and she was not breathing. Falkenberg and Næsheim, both doctors, began giving her cardiopulmonary resuscitation (CPR). The rescue helicopter soon arrived and Bågenholm was brought to the Tromsø University Hospital in an hour. The helicopter emergency team continued to give her CPR during the flight, and she was ventilated with oxygen. She was also treated with a defibrillator, but to no effect.*

*Bågenholm arrived at the hospital at 21:10. Her body temperature at the time was 13.7°C (56.7°F), the lowest survived body temperature ever recorded in a human with accidental hypothermia, until fellow Swede Stella, 7 years old, survived 13.0 °C (55.4 °F) at Christmas 2010 . Dr Mads Gilbert, an anesthesiologist and the chief of the hospital's emergency room, proceeded with the resuscitation attempt. He commented on Bågenholm's state: "She has completely dilated pupils. She is ashen, flaxen white. She's wet. She's ice cold when I touch her skin, and she looks absolutely dead." Gilbert had treated many cases of hypothermia before because of the cold climate in Norway, and knew how to treat Bågenholm. The electrocardiogram connected to her showed no signs of life, but Gilbert knew patients should be "warmed up before you declare them dead." He and his team hoped Bågenholm's brain had received enough oxygen from the CPR she was given after her rescue.*

*Bågenholm was brought to the operating theatre, where a team of more than a hundred doctors and nurses worked in shifts for nine hours to save her life. At 21:40, she was connected to a cardiopulmonary bypass machine that warmed up her blood outside of her body before it was reinserted into her veins. Bågenholm's first heart beat was recorded at 22:15, and her body temperature had risen to 36.4°C (97.5°F) at 0:49. Bågenholm's lung function deteriorated at 02:20, and she spent the following 35 days connected to a ventilator.*

*Bågenholm soon began to show signs of vitality, and woke up paralyzed from the neck down on 30 May. She feared she would spend the rest of her life on her back, and was angry with her colleagues for saving her. Bågenholm soon recovered from the paralysis, however, and later apologized to her friends; "I was very irritated when I realized they had saved me. I feared a meaningless life, without any dignity. Now I am very happy to be alive and want to apologize." Bågenholm's kidneys and digestive system were not working properly, so she had to recover in an intensive care unit for two more months. After spending 28 days in the Tromsø intensive care unit, she was flown to Sweden in an ambulance helicopter for the remainder of her recovery.*

retrieved from Wikipedia on June 4, 2016

[https://en.wikipedia.org/w/index.php?title=Anna\\_Bågenholm&oldid=717362257](https://en.wikipedia.org/w/index.php?title=Anna_Bågenholm&oldid=717362257)

Cold does have a protective effect on the body, lowering the amount of oxygen required to keep the tissue alive. For each 1°C drop in core temperature there is a roughly 15% decrease in the metabolic rate. One estimate was that Bågenholm's metabolic rate dropped to only 10% of her baseline (normal) activity, vastly reducing the need for oxygen. Remember that "a hypothermia casualty is not dead until warm and dead."