Hypothermia

Written by Lindell Forbes EMT-P
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Hypothermia is often the last thing on a paramedic's minds as they work up a sweat trying to help a victim, but hypothermia is a significant problem that is often overlooked.

Outdoor sports are becoming more popular and more risky. As people take part in these adventures they are become potential victims. EMS is seeing most cold exposure calls in urban settings where the public would not expect hypothermia to be a problem. Alcohol and drug abuse, mental illness and homelessness contribute to the majority of outdoor cold exposure cases.

Cases of hypothermia occurring indoors are just as common if not more common then those that occur outdoors. Incidences of falls that result in the victims lying on the ground for hours or even days are increasing. With a growing number of older Americans living alone without outside help these incidents will continue to increase.

Objectives

Our objective in this article will be to.

- Learn what hypothermia is.
- Learn how hypothermia happens.
- Understand that underlying diseases can cause hypothermia.
- Learn the signs and symptoms for each severity of hypothermia
- Understand the treatment for hypothermia how it is different from other treatment protocols
- Understand the special concerns related to hypothermic patients.

What is Hypothermia

Hypothermia is a medical condition which the patient's body temperature is below 95 degrees

Fahrenheit. Hypothermia can come in two categories. The first is intentional. Intentional hypothermia is when a patient's body temperature is dropped for medical reasons. The second is accidental. We will be discussing accidental hypothermia. Accidental hypothermia is broken down into primary and secondary hypothermia.

Primary hypothermia occurs when the victims low body temperature is the result of exposure to cold. Secondary hypothermia is when a patients body temperature falls as a result of a medical illness such as hypoglycemia.

On average there are 700 deaths are due to hypothermia each year. 12,000 deaths were reported from1979 to 1995 where the cause of death was hypothermia, but that number may be higher. Because some medical conditions can cause a patient to become hypothermic, hypothermia is often viewed as a symptom rather then a separate medical condition. All ages and races are venerable but the very young and the very old are must often affected. Over 50% of hypothermia deaths were older then 65 years old. Minorities are more frequently victims of hypothermia as well due to large numbers of minorities that make up the population of homeless and untreated mental patients.

The elderly population is especially vulnerable since many live in poverty and have inadequate heating systems or may not be able to afford the rising prices of energy.

How do people become hypothermic

The human body temperature is normally around 98.6F. To maintain this temperature the body generates its own heat using the food we eat as fuel. This is called thermoregulation. Thermoregulation is controlled in the brain by the hypothalamus. When the body's temperature falls below 95 F the heat generating process is disrupted. The hypothalamus will attempt to increase to body's temperature with involuntary muscle contractions or shivering. Shivering can raise the victim's temperature but mostly shivering serves to maintain the body temperature until an outside source of heat raises the body temperature.

Primary hypothermia results from direct contact with the cold. An example of this could be a skier who gets lost and spends the night outside or an elderly man who falls and spends the night on the tile floor of his bathroom. In both of these cases, the patients become hypothermic as a result of direct contact with cold but the situation and the patients are very different.

The body losses heat in different ways.

- Radiation is when the body's heat is lost to the cold air around the victim.

- Conduction is when a cold object that the victim is near pulls heat from the body.
- Convection is when wind moves heat away from the victim's body.

Heat can be loss by evaporation and through respiration but these routes result in little heat loss when compared to the radiation, conduction and convection. If the victim is wet body heat will be lost much faster.

In the case of the skier the victim is most likely young and healthy. The skier may be dressed for physical activity in cold weather but is unlikely prepared to be inactive in a cold environment. The skier will primarily lose heat through radiation and conduction. Heat will leave the skiers body and move into the surrounding cold air. Heat lost via this route will be faster if the victims head is uncovered. If the skier sits in the snow or seeks shelter near a rock out cropping heat will be pulled from his body by the cold snow or rock. If the wind blows even slightly then heat loss through convection will occur. If the victim is wet then the wind will have a greater impact. Being young and healthy this victim may have adequate body mass and fat stores to burn and generate heat. He will also be able to shiver vigorously in order to maintain his body temperature. This victim will also be able to generate heat with physical activity such as jumping jacks or walking in circles. A night in the cold will be uncomfortable for this victim but most likely it will not be life threat.

The victim who fell on the floor is in a much different situation. The victim on the floor is elderly and may be healthy but most likely he has several chronic medical problems. These medical conditions may make predisposed to hypothermia. While the victim may have plenty of body mass and fat stores the victims body may not be able to convert it into energy efficiently. This victim's chronic medical condition may leave him weak and enable to move or shiver effectively. This victim is also more vulnerable to injuries that may occur in the fall especially fractured bones. Since the victim fell in the bathroom during the night it is likely that he is not dressed in warm clothing and may be wet with urine. The victim will lose some heat through radiation but most will be lost through conduction. Tile, stone and cement are 100 times more conductive of the cold then air. Inside homes where the room temperature is around 70 degrees the floor may be 20 degrees cooler. A poorly insulated victim lying on tile, stone, cement or even a wood floor will become hypothermic quickly. This victim is in a very dangerous situation since it is not known when or if he

will receive help. If he does not receive help soon then he will be at risk of dying as a result of exposure.

Medical illness and traumatic injuries may also cause hypothermia. In theses cases hypothermia is often seen a byproduct of the main diagnosis and is categorized as secondary hypothermia. The problems, however that hypothermia presents are still present and if they are not dealt with it may pose as much of a danger to the patient as the primary diagnosis.

Injuries that damage the nervous system such as

neck or back injuries and head injuries may lead to hypothermia. In this case, heat lose will not only come from exposure but also from the body being unable to produce heat due to central nervous system damage. If the CNS is unable to process information sent from the peripheral and central thermal sensors then the hypothalamus will not send out the order for the body to generate heat. The same problem can occur in a victim who has suffered a brain injury secondary to a CVA. Burns are another way that patient may become hypothermic as a result of trauma. In the case of a burn, heat loss is expatiated by the victim's inability to conserve heat.

Hypothermia can result as a byproduct of chronic medical conditions as well. Hypothyroidism, malnutrition, hypoglycemia and neuromuscular inefficiencies can all be the underlying cause of hypothermia. Medications used to treat chronic conditions may also increase a patient's risk of hypothermia especially if they cause vasodilatation or are a CNS depressant. EMS may also cause hypothermia by giving IV medications or IV fluids that are cold. To protect against this store rooms and ambulances should be kept at recommended temperatures.

Assessment

Assessing a patient who is hypothermic presents special challenges. Patients that are hypothermic can have symptoms as minor as clumsiness or as severe as profound bradycardia. Hypothermia can occur in any environment where the ambient temperature is lower then body temperature so it should be suspect in all seasons. In patients with chronic endocrine or neuromuscular diseases hypothermia should considered especially when the patient is not responding to standard treatment. Some of the diseases may be

- Anorexia or severe malnutrition
- Hypopituitarism
- Hypoadrenalism
- Hypothyroidism
- Hypoglycemia
- Paralysis
- Multiple sclerosis
- CVA
- Spinal cord injury
- Induced vasodilatation from pharmacologic agents
- Burns
- Cold IV fluid infusion
- Drug overdose

Hypothermia is placed into three severities.

- Mild hypothermia
  - 32-35 degrees C 89.6-95 degrees F
  - Tachypnea
  - Vasoconstriction
  - Tachycardia
  - Lethargy
  - Confusion
  - Shivering
  - Loss of fine motor coordination

At 93.2 F most people began to shiver vigorously. They will have altered judgment, amnesia and slurred speech. At 91.4 F the victim will show apathy and have difficulty moving. At this stage of hypothermia the body is less capable of increasing body temperature. The body will use stored fuels such as

fat, hormones and small proteins to generate heat in order to maintain the body temperature. This patient is generally hemodynamically stable and able to compensate. Most healthy people can tolerate mild hypothermia but as the body temperature drops the CNS becomes depressed and is less able to maintain.

- Moderate hypothermia
  - 28-32 degrees C 82.4-89.6 degrees F
  - Shivering stops
  - LOC diminishes
  - Bradycardia
  - Cold diuresis
  - Delirium
  - Slow reflexes

When the patient reaches 89.6 degrees F the oxygen consumption will began to decrease and the CNS will become depressed to the point that it will no longer be able to compensate. The victim will present in a stupor and will have lost the ability to shiver. At this temperature the patient will be at risk of atrial and ventricular arrhythmias. Depolarization of the cardiac pacemaker will be reduced resulting in bradycardia and decreased cardiac output. The victim's pupils may become dilated and unresponsive to light. The victim at this point can be easily misdiagnosed as brain dead.

Victims suffering from have moderate hypothermia have a 21% mortality rate if not promptly and correctly treated.

- Severe hypothermia
  - <28 degrees C < 82.4 degrees F
  - VERY cold skin
  - Hypotension
  - Pulmonary edema
  - Unresponsive
  - Coma
  - Difficulty breathing or apnea
  - Abnormal heart rhythm

At 82.4 degrees F the body becomes very vulnerable to ventricular fibrillation and decreased myocardial contractility. The body will be rigid and all reflexes will be absent. The pupils will be fixed and dilated but in this case it is not a sign of brain death. The patient should be handled gently. Rough movement can cause the patent to go into ventricular fibrillation. While it may appear that the patient is dead at this stage it is important to remember that the signs that EMS use to determine death in the field are unreliable in cases of hypothermia. This fact should be considered when making resuscitation decisions.

During the initial assessment the diagnosis of hypothermia is easy especially in cases of exposure

but when medical problems are involved diagnosis can become very difficult. Tools used to determine temperature in the field are not accurate in cases of hypothermia so suspicion is the most useful assessment tool that EMS has. A detailed history is very important to the assessment. Not only should a medical history be obtained but a history of the patients activities. This could provide clues to exposures that EMS may not be aware of but always keep in mind that a patient does not need to be someplace cold to become hypothermic.

Treatment

Treating a patient who is a victim of hypothermia requires special care. Rough handling can lead to arrhythmias and treating those arrhythmias can lead to toxicity once the patient is rewarmed.

In cases of moderate to severe hypothermia the primary concern when treating a hypothermic patient is to prevent arrhythmia and to prevent the patient's body temperature from falling any further. If the patient is wet, then the clothing should be removed. The patient should be covered with blankets to preserve

heat. Active rewarming should not take place in the field.

The treatment protocol for treating “Cold Exposure” can be found on page 27 of the SPEMS protocol. This protocol should be used to treat patients suffering from moderate to severe hypothermia. Patients suffering from mild hypothermia should be treated with warm blankets and placed in a warm environment. An IV access should be obtained and the EKG should be monitored as directed in the protocols if the patient is conscious.

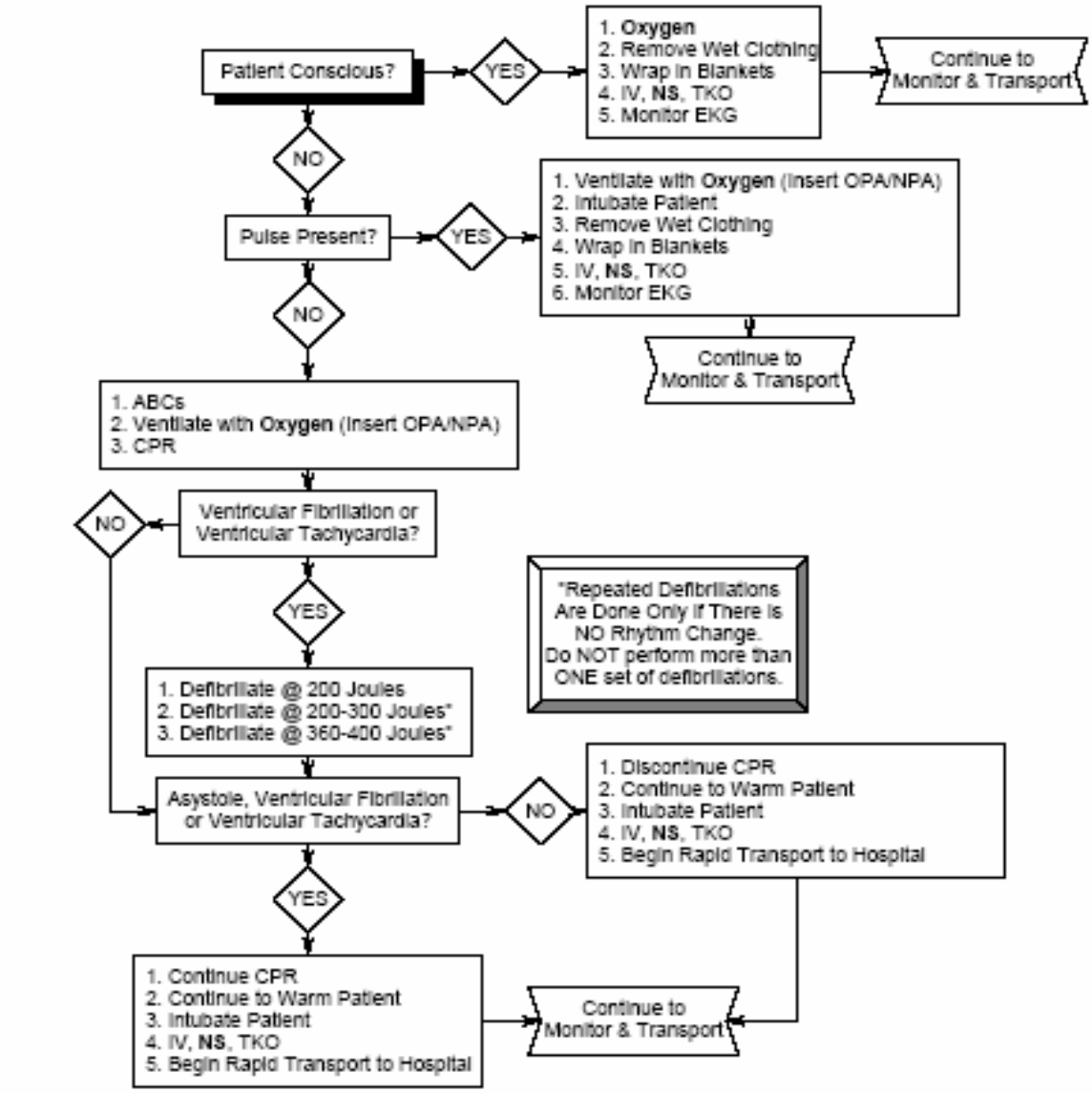
If the patient is unconscious then you should assess the pulse. Since the patient will be bradycardic and hypotensive, the pulse should be felt for several seconds. If a pulse is present then, the patient’s airway should be secured, an IV started and the cardiac rhythm monitored. If a pulse is not present, then the airway should be secured, CPR started and quick look should be done. If the patient

is in ventricular tachycardia or fibrillation then three stacked shocks should be delivered. If the patient is in PEA then CPR should be stopped. The heart may be pumping so slowly and the cardiac output may be so small that a pulse can not be felt but the heart is operating. The

trauma caused by CPR may cause the patient to go into ventricular fibrillation. If after the initial shocks, the patient is still in ventricular fibrillation ventricular tachycardia or asystole then CPR should be continued. Do not shock the patient again unless there is a rhythm change. The reason that the patient is in V-fib is because of his body temperature and until the patient is rewarmed repeated defibrillations will only cause damage to the myocardium. An IV should be started and the patient should be covered with blankets. The patient should be transported rapidly and gently. Medications should be avoided because they cannot be circulated in the bloodstream of a hypothermic patient. If given they will remain in the extremity that they were injected into until blood flow resumes. Then they will travel through the body as one large bolus rather then as the dosages intended. This may result in toxicity. Medications should also be avoided because the arrhythmias are caused secondary to hypothermia. Ventricular fibrillation will be resistant to lidocaine because it was not caused by ventricular irritability. Asystole and bradycardia will be resistant to atropine since it was not the result of increased vagal tone. Once the patient has been rewarmed in the ER, then medications can be used as needed but once the cardiac and CNS and no longer under the effect of the cold then it may not be necessary.

COLD EXPOSURE (SYSTEMIC HYPOTHERMIA)

(Estimated Core Temp. < 90F)



- Suspect Hypothermia in any Patient with An Altered Level of Consciousness in a Cool Environment
- Move ALL Patients Gently, to Avoid Serious Dysrhythmias
- Do Not Actively Rewarm Patient in Prehospital Environment
- Avoid Extensive Advanced Life Support in Prehospital Environment
- Resuscitate ALL Cardiac Arrest Patients who are Hypothermic

In cases of hypothermia, EMS plays a vital role. Information gathered by paramedics on the scene can aid in determining if the hypothermia is primary or secondary. EMS can treat many of the underlying illnesses. EMS can prevent hypothermia by understand the underlying causes. EMS can aid the community by helping those who need help and prevent deaths related to exposure. To the man who has spent the night on his bathroom floor the help that a paramedic has to offer is much appreciated even if the words “thank you” is not said.

Since starting this article it has been discovered that an elderly couple has died in Lubbock as a result of hypothermia. The couple could not afford to pay for their utilities and as a result had both their natural gas and electricity cut off. This couple fit the profile of a hypothermia victim in every way. Sadly they provide proof that Hypothermia can take lives in Lubbock.

Resources and Credits

www.emedicine.com “Hypothermia” September 22 2005 James Li MD

www.emedicien.com “Hypothermia” March 28 2005 Grant Phillips MD

Photos

L. Forbes

www.strangesports.com

www.intrepidesplorer.net

Montana search and rescue

www.cheeseheaduniversity.com

www.uscg.mil/

www.endlesswinter.co.uk/st.html

www.topleftpixel.com

www.uky.edu