

Chill Out

Hypothermia: Accidental and Induced

Categories of Hypothermia

Mild _____

Moderate _____

Severe _____

Accidental

Predisposing Factors

Fatigue extremes of age malnutrition dehydration
pre-existing acute illnesses pre-existing chronic conditions Alcohol certain
medications

Environment Factors

Clothing Wet/Dry Convection Conduction Cold Water Immersion

How We Stay Warm

Internal heat comes from cellular metabolism and muscle movement. Additional heat can be produced from

2nd Law of Thermodynamics

“It is impossible for a process to have as its sole result the transfer of heat from a cooler body to a hotter one”

In simple English this means that as long as there is an object that is warmer than another object next to it, the warmer object will continue to give up heat until both objects are the same temperature. In this case, even air is considered an object. Think about it, your body constantly puts out heat. In 98 degree weather, we can't cool off because the air around us is the same temperature. But what about sitting on a cold metal chair? Our butt gets awful cold in an attempt to heat that seat to 98 degrees and in the process our skin and the seat become the same temperature. This is an important law to remember (as if all the thermodynamic laws aren't important.... Ha!)

So how do we compensate for heat loss?

Goosebumps Vasoconstriction Sympathetic Responses Shivering

Shivering

The most efficient exercise in terms of heat generated per calorie expended. If a person can still shiver they have the ability to re-warm themselves at a rate of 2 degrees celcius per hour.

BUT

It IS strenuous exercise and causes fatigue as well as consuming glycogen stores. Insulin deficit can occur also.

Temperature Taking

When it comes to taking a temperature, rectal is the only way to go. Sorry folks, but it is true. I don't care if you make the rookie do this job or rock-paper-scissors for the task. It is important to get an accurate core temp so you know what you are dealing with. Keep in mind, most household thermometers only go down to 94 degrees. Make sure you are using an approved healthcare standard medical thermometer that goes down to at least 86 degrees.

Signs and Symptoms of Hypothermia

Symptoms of hypothermia gradually get worse as you can expect. Mild symptoms include lethargy, shivering, lack of coordination, pale cold dry skin, initial rise in BP and pulse. As the temperature continues to drop the patient STOPS shivering, loses voluntary muscle control, develops hypotension and towards the very end can appear DEAD. BUT BE CAREFUL WITH ASSUMING THEY ARE DEAD.

Alaska Guidelines for Rescue state a person isn't cold and dead until...

Obvious Fatal Injuries

Chest Frozen and non-compressible

Ice formation in airway

Exhaustion of, or danger to, the rescuers

Cold Water Submersion of greater than 1 hour duration

Core Temperature less the 50°F.

According to hypothermia.org, "The first _____ during rescue is the most critical phase of hypothermia management"

Re-Warming for MILD hypothermia

Remove wet clothes

Put something dry and insulating between pt and backboard

Apply warm blankets

Warm Sweet Drinks _____ is the most important factor here.

Warm IV fluids.

Remember: Snuggling is only safe and effective with MILD hypothermia. Remember that
2nd Law of Thermodynamics?

Re-Warming for MODERATE hypothermia

Same interventions as for mild hypothermia PLUS.....

Keep pt horizontal

No Rough Handling, minimize movement

SEVERE Hypothermia

Slow, careful pulse check (at least 60 seconds)

EKG Confirmation

CPR decision

Limited Resuscitation

Not much success will be seen until the core temp exceeds 86 degrees.

_____ waves are seen on EKG when the body is less than 86 degrees.

Severe Hypothermia Treatment

Heated Oxygen, if you can get it.

EKG - priority!

Add just enough gentle heat to protect from further heat loss.

Check their sugar, consider dextrose, maybe even insulin.

Cold Diuresis

As the body cools down, the kidneys begin a protective process. _____ hormone is decreased. This results in _____.

After Drop Phenomenon

Occurs with EXTERNAL rewarming measures. Warming the _____ => vasodilation => causes return of cold blood to central circulation. In order to prevent this, rewarm the _____ only.

Ideal re-warming no faster than _____ per hour. Warm from the inside to the outside. Any faster than this can lead to _____.

Core rewarming measures you see in the ER but isn't likely in an EMS setting...

Mediastinal lavage Extracorporeal Rewarming Gastric Lavage Warm Water
Enemas Radiowave diathermy Peritoneal Lavage

There are many really reputable resources out there that has an opinion on how far we go to resuscitate hypothermic patients. *American Heart Association, Journal of American Medical Association, Alaska Guidelines for Rescue, www.hypothermia.org, Princeton Outdoor Guide for Survival*, etc. We need to be aware of what our protocols say we should do in these cases and be educated on the above mentioned physiological changes that the body undergoes in order to preserve itself.

Cardiology

All of the above organizations do agree however that once a really cold patient goes in to V-Fib, there isn't much that can be done as cold induced V-Fib isn't successfully converted with the typical V-Fib interventions.

Airway and Medications

Drugs aren't metabolized efficiently in a cold liver. In fact, medications stay in the periphery until the body warms up and circulation starts back up. THEN, all of that medication creates a bolus to the heart.

While intubation is considered rough handling sometimes, there hasn't been an increased risk of inducing ventricular fibrillation from this procedure and, if you have access to heated oxygen, can improve the patient's outcome.

Know your agency's rules on Code Terminations. Many agencies hold to the old, "They are dead until they are warm and dead" philosophy. Others agencies, especially if the service area is rural, say to give definitive care is over 3 hours away, work the code for 30 minutes and call it if still no signs of life.

Cold Water Specific

The definition of "cold water" is 60 degrees or less. Sometimes you will have a protocol specific for cold water, sometimes you just have to follow your general environment emergency protocols. A tip though..... Get a core temperature as well as the water temperature AND the estimated time the patient was in the water. This really helps when you are giving report, charting and justifying your actions.

Don't forget those little old people who have been lying on a cold tile floor all night, regardless of the ambient temperature.

Therapeutic Hypothermia

Qualifications for inducing hypothermia

Cardiac Arrest with ROSC Can maintain a SBP >90* Over age 18
Head CT scan without acute intracranial process
Persistent Coma not related to other factors (drugs, carbon monoxide, etc)

Contraindications

Pregnancy A different reason for coma Hypothermic before cooling efforts began

Side Effects of Hypothermia

Good Side Effects of Chillin'

Controls inflammation Decreases oxygen consumption
Minimizes multi-organ dysfunction Syndrome (MODS)
Decreases potassium in the blood as the temp falls Decreases ICP
Anti-Convulsant Decreases Cerebral Metabolic Rate Inhibits Cell Destruction
Inhibits Free Oxygen Radical Formation

Free Radicals

Extra oxygen molecules attach to healthy cells and creates by-products. 21% oxygen is relatively stable which is why we have survival for many millennia on room air.

Post-resuscitation encephalopathy accounts for _____ of ROSC to die later on despite successful initial resuscitation efforts.

Starting the Chill (EMS style)

ABC's (intubate and keep sedated and paralyzed)

12 EKG

IV with iced NS* (_____ over 30 minutes => _____ mL/Hr drip)

Cold packs to armpits and groin

Monitor Temperature - goal is to get to 91° => 3 hours.

DO NOT INITIATE COOLING IF IT CAN'T BE CONTINUED

Iced Saline is considered _____ degrees F.

Continuing the Chill (ER/ICU style)

Stat Labs

Plain Head CT

Chest X-Ray

Art Line

Central Line or Coolguard Catheter

Central Venous Pressure monitor

Foley (criticore is awesome)

Cooling Blankets

When you transport a pt under induced hypothermic protocol measures...

Cardiac monitor, Temp, SaO₂ and ETCO₂

Turn off the ambient heat

Paralytics and Sedation (to prevent shivering)

Document the exact time the patient reaches 91⁰

Maintain MAP > 90 mmHg (use pressors prn)

Keep pt cold for ____ hours (no going back)

The effects of induced hypothermia

Gives the brain a chance to recover before assuming the workload again

Reduces brain oxygen consumption by _____ for every ____ degree drop in temp.

Suppresses chemical reactions associated with reperfusion injury.