

EM Basic- Hypothermia

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Normal core body temperature – 37°C +/- .5°C (98.6°F +/- .9°F)

Hypothermia – core temperature below 35°C (95°F)

Mechanism – heat loss becomes so great that the body's regulatory mechanisms (ex. shivering) are overwhelmed and can no longer sustain an adequate body temperature

History

HPI

Obvious environmental exposure present?

Was patient outside when suddenly became uncooperative, uncoordinated, and apathetic?

Non-specific symptoms such as hunger, nausea, chills, dyspnea, confusion present?

PEARL – In the elderly, hypothermia often occurs indoors and the only signs may be a decrease in communication and/or a flat affect

Past Medical Hx

Any pre-existing cardiac, pulmonary, neurologic, or endocrinologic disease?

Signs of hypothermia by stage

Mild (32-35°C/82-90°F) – increased shivering thermogenesis, amnesia/dysarthria, hyperventilation, urine temp ~34.8°C

Vitals – tachypnea, tachycardia, normal BP

Moderate (28-32°C/82-90°F) – stupor/progressive ↓ in level of consciousness, poikilothermia, cardiac arrhythmias, hypoventilation, dilated pupils, hyporeflexia

Vitals – proportionate ↓ in pulse and respiratory rate

Severe (<28°C/82°F) – greatest susceptibility to ventricular arrhythmias, loss of reflexes and voluntary motion, loss of corneal/oculocephalic reflexes, acid base disturbances, pulmonary edema

Vitals – 50% or more ↓ in O₂ consumption and pulse, marked hypotension

Physical Exam

General – scan patient's entire body, looking for frostbite/cold-related injury and trauma

Measuring core temperature:

Mild-moderate hypothermia – use rectal probe or bladder thermometer

Critical patients with severe hypothermia – use esophageal probe

PEARL – the hypothermic heart is very sensitive to movement, so avoid jostling the patient as this could provoke an arrhythmia such as v-fib

Workup

Fingerstick glucose (degree of hypothermia) - ↑ in acute hypothermia

↓ in subacute/chronic hypothermia

Fibrinogen level (hypothermia can lead to a DIC-type syndrome)

CBC (leucopenia, thrombocytopenia, ↑ hematocrit)

CMP (baseline electrolytes, renal failure, ischemic pancreatitis)

Lactate/ABG uncorrected for temp (acid-base abnormalities)

CPK (rhabdomyolysis)

EKG (prolongation all intervals, Osborn wave in V2-V5)

Imaging

CXR (pulmonary edema, aspiration pneumonia)

Spinal Xrays (if pt. not alert and any possibility of trauma)

Differential Diagnosis

Endocrinologic causes (hypopituitarism, hypoadrenalism, myxedema) – suspect in a patient that fails to rewarm despite aggressive interventions; order serum cortisol and thyroid function studies

Hypoglycemia, hypovolemia, overdose – suspect one of these if patient has a relative tachycardia that doesn't coincide with core temp

Underlying acidosis (DKA, ASA OD) – suspect if patient has a relative hyperventilation; order UA and serum salicylate level

Malnutrition – d/t decrease in subQ fat and thus loss of insulation

Medications – anxiolytics, antidepressants, antipsychotics, opioids, or antihyperglycemics, beta-blockers, general anesthetic agents, and alpha-adrenergic agonists (clonidine)

Management

Airway – endotracheal intubations in pts with resp distress or who cannot protect their airway

Breathing – O₂, heated and humidified if possible

Circulation

2 large bore 14 or 16 gauge peripheral IVs (or IO line)

Isotonic saline warmed to 40-42°C

Check central pulse with Doppler U/S up to 1 min

If in cardiac arrest, begin chest compressions

Continue resuscitation until core temp 32-35°C

Biochemical markers indicating futile resuscitation

Extreme hyperkalemia > 10-12 mEq/L

Fibrinogen level < 50 mg/dL

Ammonia level > 420 ug/dL

PEARL – it's essential to use warmed saline bc room temp saline can worsen hypothermia

Monitoring

Temperature – see “Physical exam”

Vascular fluid shifts – indwelling bladder catheter with urine meter bag in pts with moderate-severe hypothermia

Rewarming

Passive external rewarming (mild hypothermia)

Cover patient with insulating material and set room temp to 82°C

If pt can't maintain rewarming of .5-2°C/hr, use active techniques

Active external rewarming (mild-moderate hypothermia or those who don't respond to passive techniques)

Uses warm blankets, heating pads, warm baths, or forced air warming systems that apply heat directly to skin

Warm patient's trunk BEFORE extremities to avoid core temp afterdrop

Children should not be rewarmed by active external techniques alone

Active internal/core rewarming (severe hypothermia or those who fail to respond to active external techniques)

Start with least invasive methods 1st and gradually work up if core temp not increasing by at least 2°C/hr:

1. Heated IV saline (40-42°C) and warmed humidified O₂
2. Peritoneal and/or pleural irrigation with 40-42°C saline
3. Endovascular warming device

4. Extracorporeal blood rewarming: venovenous, hemodialysis, continuous arteriovenous rewarming, cardiopulmonary bypass, extracorporeal membrane oxygenation

Arrhythmias

Definitive management focused on rewarming since most resolve and are n treatable at higher core temperature

Bradycardia

Physiologic in severe hypothermia

Pacing not necessary unless persists after patient rewarmed to 32-3

If pacing necessary, transcutaneous preferred

Atrial arrhythmias – common below 32°C, convert on rewarming

Ventricular arrhythmias

If patient in cardiac arrest, attempt defibrillation with single shock

If shock unsuccessful, further single shocks attempted with every 1-

↑ in core temp

Vasopressors may or may not be attempted (no consensus)

Failure to rewarm

- If patient has obvious source of infection or fails to raise his/her body temp greater than .67°C/hr despite appropriate rewarming measures → empiric tx with broad spectrum IV AB
- If patient has potential adrenocortical insufficiency → 100 mg hydrocortisone IV or 4 mg dexamethasone IV
- If patient has hx hypothyroidism or suggestive neck scar → draw thyroid function studies and then give 250-500 mcg levothyroxine IV over several minutes (patient will receive daily injections of 5 100 mcg for 5-7 days)

Cold-induced skin injuries

Treat after patient's core temp is stable

Warm water baths of affected areas for 15-30 min w/40-42°C water

Tetanus toxoid and analgesia as needed

Disposition

Mild primary accidental hypothermia – discharge once rewarmed

Moderate-severe hypothermia – usually admit to medicine

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