

Hypothermia

Definitions

“Clinical state of subnormal temperature when the body is unable to generate sufficient heat to efficiently maintain normal body functions.”

- Mild (32-35)
- Moderate (28-32)
- Severe (20-28)
- Profound (<20)

Heat generation and loss usually balanced; body can vary metabolic rate and tissues involved to maintain core temperature for wide range of rates of loss. If heat loss exceeds ability to compensate, (excess of former or reduction in latter), hypothermia will result.

Clinical Features

Mild

- Shivering
- Altered judgement
- Amnesia
- Dysarthria
- Ataxia

Moderate

- ‘Paradoxical undressing’
- Stupor
- Shivering ceases
- Pupils dilated/sluggish

Severe

- Coma
- ‘Apparent death’

Confirm with low reading thermometer – rectal (or oesophageal) – other sites can be misleading

Causes

Environmental

- Sudden – fall into cold water, avalanche
- Sub-acute – injury in cool environment, no heating

Reduced compensation (often more subtle – look out for it)

- Older age
- Sepsis
- Major trauma
- Anaesthesia
- Thyroid disease
- Alcohol
- (etc, etc...)

Consequences

Cardiovascular

- Bradycardias
- Arrhythmias
- Asystole
- Increased then Decreased Cardiac Output
- Paradoxical Diuresis with haemoconcentration and hypovolaemia
- ECG Changes – Osborn J waves

Respiratory

- Stimulation then depression
- Depression of cough reflex (risk of aspiration)
- Cessation of respiratory drive at 24°C
- Left shift of O₂ dissociation curve – reduced oxygen release to tissues

Neurological

- Confusion at around 35°C
- Ataxia, change in personality, odd behaviour
- Loss of consciousness at around 30°C
- Reduction in Cerebral Blood Flow by 7% per 1°C drop
- Corresponding decrease in Cerebral Metabolic Rate
- Muscle rigidity and decreased tendon reflexes
- Unreactive mydriasis

Metabolic

- Shivering drives up metabolic rate and O₂ consumption
- Below 30°C shivering ceases and BMR drops by about 6% per 1°C drop
- Metabolic acidosis (don't correct for temperature – analyser will warm sample to 37, values should then be as expected)

Haematological

- At 35°C clotting factor and platelet function is compromised.

- DIC
- Neutropenia and thrombocytopenia secondary to splenic sequestration – may mask evidence of sepsis

Treatment

- ABCDE
- Address underlying causes
- Rewarm – most problems resolve with restoration of normothermia
- Often need IV fluids

Rewarming

Passive

- Useful in mild cases where body heat is still produced
- Keep dry
- Increase ambient temperature
- Insulating layers; think about what they're lying on

Active

- Bair hugger (forced air warming blanket)
- Warmed IV fluids (little increase in temperature; avoids losing more if they're being given anyway)
- Warmed, humidified oxygen
- Lavage of any body cavity – gastric, pleural, peritoneal, bladder
- Extracorporeal – haemodialysis, ECMO, cardiac bypass

Watch out for afterdrop – sudden decrease in core temperature after warming initiated

Cardiac arrest

'You're not dead until you're warm and dead' – provided the hypothermia caused the arrest or was induced rapidly at the same time. Post-mortem cooling to room temperature does not need to be warmed.

Reported cases of survival after hours of resuscitation.

- Active rewarming measures while resuscitation continues
- Easy to precipitate VF with intubation - caution
- May need to feel for a central pulse for one minute to confirm arrest
- No drugs below 30; double interval between doses until 35
- Up to three shocks below 30; then withhold further until above 30
- Don't overcorrect; debate about target temperature but should not go above normal