

CVS effects:

- (i) decreased cardiac output below 32 degrees with reduced MAP
- (ii) vasoconstriction below 32 degrees with increasing afterload & myocardial work
- (iii) ECG changes including widening QRS complex and increased PR interval with prolonged QT interval & J waves. Risk of ventricular fibrillation below 28 degrees
- (iv) increased blood viscosity which increases myocardial work

Respiratory effects:

- (i) decreased CO2 production
- (ii) increased anatomical & physiological dead space
- (iii) diaphragm fatigue
- (iv) metabolic acidosis causing pulmonary hypertension

Gastrointestinal effects:

- (i) decreased hepatic blood flow
- (ii) decreased liver metabolism

Metabolic effects:

- (i) decreased metabolic rate by 8% per degree
- (ii) shivering increases O2 consumption by up to 800% & resultant increase in muscle flow may accelerate heat loss
- (iii) hypothermia shifts O2 dissociation curve to the left reducing oxygen delivery
- (iv) increased stress response
- (v) hyperglycaemia secondary to increased glycogenolysis & reduced insulin
- (vi) reduced drug metabolism

CNS effects:

- (i) CNS protection
- (ii) pupils fixed and dilated below 30 degrees

Haematological effects:

- (i) increased bleeding time, increased prothrombin time & APTT
- (ii) decreased platelet count and white cell count
- (iii) increased DVT & PE
- (iv) immunosuppression

Renal effects:

- (i) GFR is reduced
- (ii) decreased renal blood flow

effects

hypothermia

causes

rewarming techniques

Age	Extremes of age
Environmental	Exposure to cold Immersion Poor living conditions
Drugs	Anaesthetic agents Phenothiazines Barbiturates Alcohol
Central nervous System disorders	Cerebrovascular accidents Trauma Spinal cord transections Brain tumours Wernicke's encephalopathy Alzheimer's and Parkinson's disease Mental illness
Endocrine dysfunction	Hypoglycaemia Diabetic ketoacidosis Hyperosmolar coma Panhypopituitarism Hypoadrenalism Hypothyroidism
Trauma	Major trauma
Debility	Severe cardiac, renal, hepatic impairment Malnutrition, sepsis
Skin disorders	Burns Exfoliative dermatitis

Passive	Warm environment >30°C (rate 0.5–1.0°C/h) Insulating cover (warm blanket)
Active, external	Conduction methods Warmed pads, blanket Convective methods (rate at 2–3°C/h) Hot air blower (e.g. Bair Hugger)
Active, core	Radiant methods Humidified warm inspired gases (rate 0.5–1.5°C/h) Warmed intravenous fluids Body cavity lavage (rate 2–3°C/h) Gastric irrigation Pleural irrigation Peritoneal dialysis Extracorporeal methods Haemodialysis, continuous arterio-venous or veno-venous re-warming (rate 5°C/h) Cardiopulmonary bypass (rate up to 10°C/h)