Hypothermia
Hyperthermia
Starvation and Neglect

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Objectives

- Identify causes for hypothermia and hyperthermia
- Identify features of hypothermia and hyperthermia
- Describe features of starvation and neglect
- Identify circumstances of death

Hypothermia

- Body temperature is usually maintained near a constant level of 36.5–37.5 ° C (97.7–99.5 ° F) through thermoregulation.

- Body core temperature below 35 ° C (95 ° F) causes heat loss from the body than heat production.

Response to hypothermia

- Efforts to increase body temperature involve shivering, increased voluntary activity, and putting on warmer clothing.

The armies of Napoleon retreat from Russia in 1812.
They faced hypothermia.

Factors involved in hypothermia

- **Low environmental temperature**
- Air temperature < 10^{0} C

- **Age and physique**
  - The elderly and the young

Factors involved in hypothermia

- Lack of subcutaneous fat
- Poor thyroid function
- Cerebral dysfunction

Circumstances

- 1. Exposure to cold
  - Dry - cold hypothermia
  - Immersion hypothermia
- 2.Exposure to cold with under the influence of alcohol or drugs
- 3. Exposure to cold with natural diseases
- 4. Therapeutic hypothermia

Diagnosis of hypothermia

- **History of exposure**
- The victim - elderly person, mountain climbers ,divers
- Past history –
  - CVA
  - Hypothyroidism
  - Alcoholism
  - Diabetes

Diagnosis of hypothermia

- Patches of pink to brownish - pink on the extensor surfaces and large joints
- Cyanosed extremities

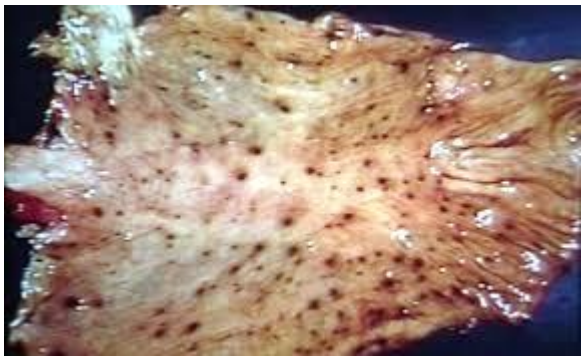
Diagnosis of hypothermia

- Frost bites- blisters and gangrene

- Reddish flat nodule in the skin

Diagnosis of hypothermia

- Acute pulmonary oedema
- Acute gastric erosions
- Acute pancreatitis
- Peri-vascular haemorrhages in the wall of third ventricle
- Micro-infarcts in organs



“Hide and die syndrome” or Terminal burrowing

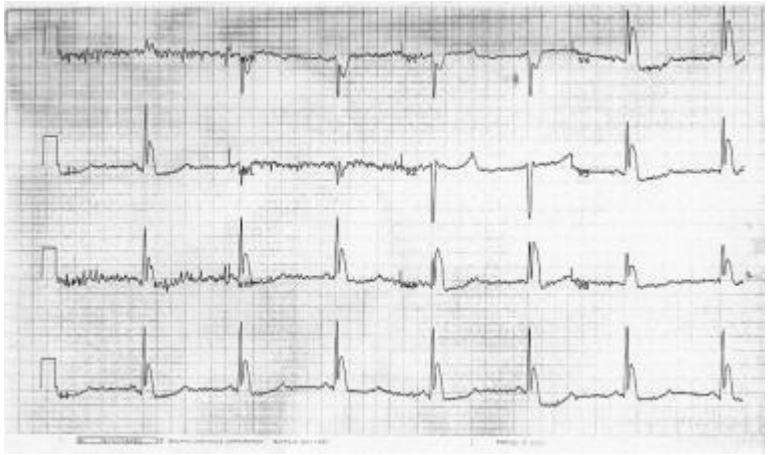
- The afflicted will enter small, enclosed spaces, such as underneath beds or behind wardrobes.
- It is often associated with paradoxical undressing.
- Usually an old person, mostly in cases where temperature drops slowly.

Cause of death in Hypothermia – Titanic deaths

Hypothermia: This was the cause of death of most of the people who landed alive in the ocean. (21-31^{0}F @ North Atlantic ocean)

Mechanism and cause of death

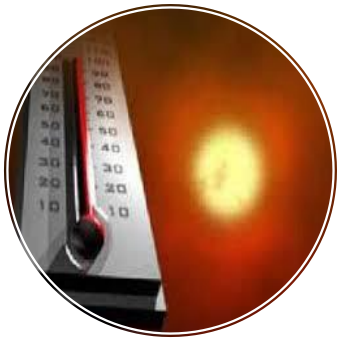
- Failure in thermoregulation
- Decrease depolarization of cardiac muscles
- CNS depression
- **Cessation of circulation preceded by arrhythmia**



Osborne (J) waves (V3) in a patient with a rectal core temperature of 26.7°C (80.1°F)

Hyperthermia

Hyperthermia



Hyperthermia

Heat exhaustion

Heat Stroke

Heat exhaustion

- Heat exhaustion –Prolonged exposure to hot conditions with increase sweating, loss of water and salt from the body
  - Eg: Exercise, sports

Heat exhaustion

- Exposure to a hot environment normally results in the activation of heat loss mechanisms, and body temperature is maintained at normal levels.
- This is an example of a negative-feedback mechanism.
- In prolonged exposure to a hot environment can result in heat exhaustion.
- The normal negative-feedback mechanisms for controlling body temperature are operating, but they are unable to maintain a normal body temperature.
- Heavy sweating results in dehydration, decreased blood volume, decreased blood pressure, and increased heart rate.

Heat exhaustion -Symptoms

- Mild dehydration
- Co-temperature 100- 104 ^{0}F
- Profuse sweating
- Thirst, nausea, vomiting
- Muscular cramps
- Confusion, giddiness
- Faintishness
- Collapse

- Relieved by the replacement of salt and water.

Heat stroke

- Heat stroke is a breakdown of the normal negative-feedback mechanisms of temperature regulation.
- If the temperature of the hypothalamus becomes too high, it no longer functions appropriately.
- Sweating stops, and the skin becomes dry and flushed.

Heat stroke -Symptoms

- Dry skin
- Body temperature is high-107-110 F
- Delirium, thirst and photophobia
- Confusion
- Coma
- Death

Circumstances

- Abundant young child under the sun
- Forced exercise
- Exposure in a desert
- Engine room
- Prolong surgery without A/C

Diagnosis of hyperthermia-Clinical

- History
- Clinical features
- Body temperature 40 to 43 C

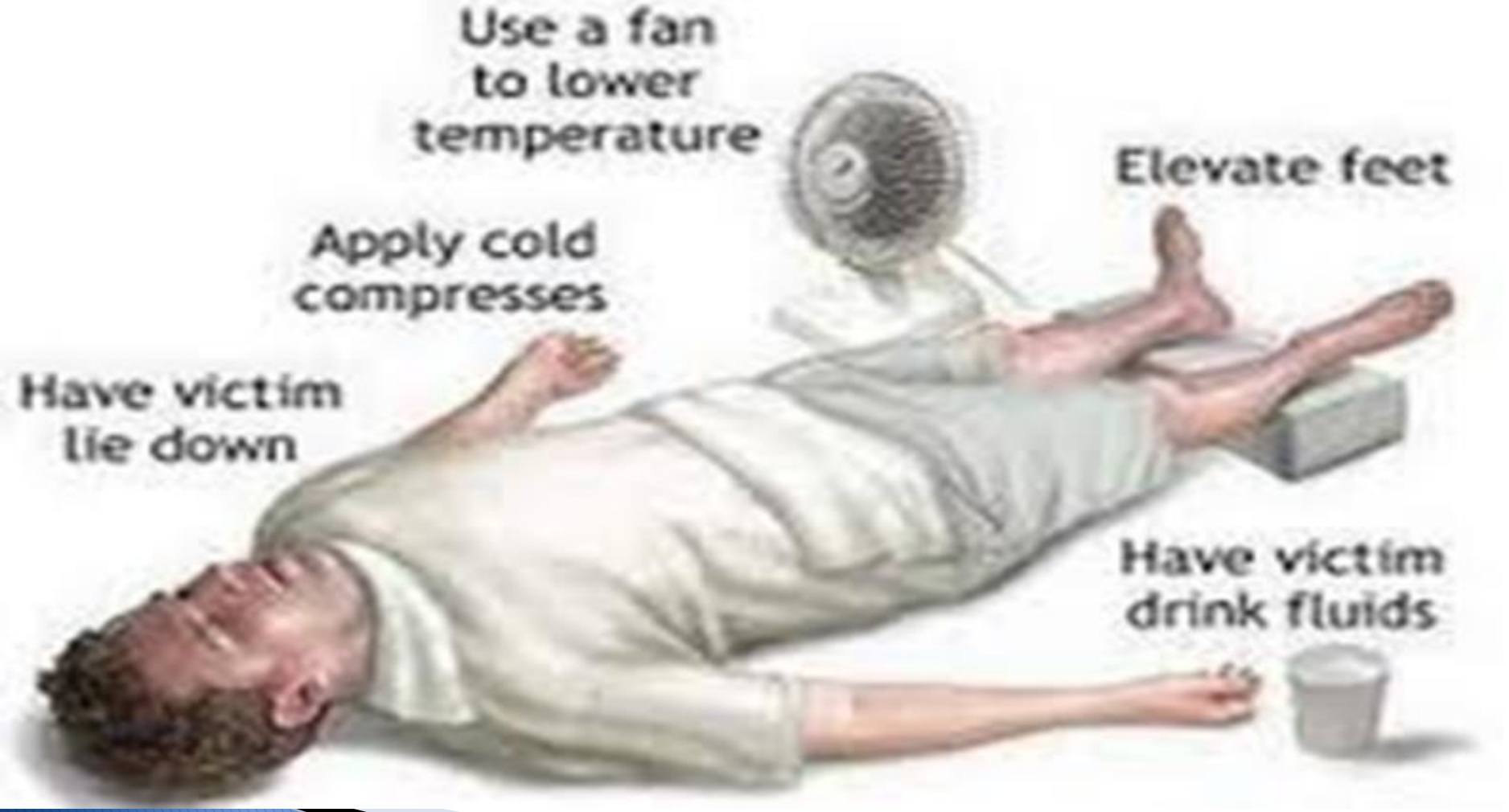
Diagnosis of hyperthermia- Post mortem

- History
- Minimal Post Mortem changes
- High rectal temperature
- Rhabdomyolysis

Diagnosis of hyperthermia

- Cerebral oedema
- ARDS
- Organ failure- Liver failure
- DIC - micro-thrombi formation and coagulative necrosis

Prevention



Adequate fluid and Electrolytes replacement

Starvation and neglect

- Severe form of malnutrition is considered as starvation.
- When it is associated with neglect, then it is important in forensic.

Malnutrition

- Substantial fat and muscle mass is broken down in malnutrition, in order to keep vital systems functioning.
- Vitamin deficiency is a common result of starvation, often leading to anemia, beriberi, pellagra, and scurvy.
- These diseases collectively cause diarrhoea, skin rashes, oedema, and heart failure.
- Individuals are often irritable and lethargic as a result.

Types of malnutrition

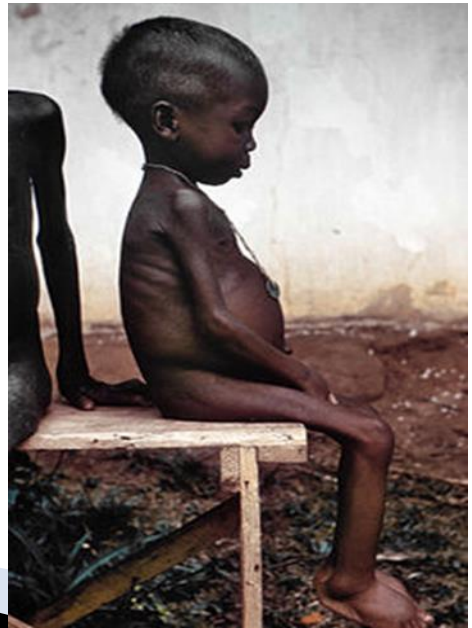
- **Marasmus**
- Marasmus is a form of severe malnutrition characterized by energy deficiency.
- A child with marasmus looks emaciated.
- Body weight is reduced to less than 60% of the normal (expected) body weight for the age.

Features of Marasmus

- Shrunken, wasted appearance,
- loss of muscle mass and subcutaneous fat mass
- Buttocks and upper limb muscle groups are usually more affected than others.
- unusual body temperature (hypothermia, pyrexia),
- Dehydration
- hypovolemic shock (weak radial pulse, cold extremities, decreased consciousness),
- evidence of infection

Types of malnutrition

- **Kwashiorkor**
- kwashiorkor is protein deficiency with adequate energy intake whereas marasmus is inadequate energy intake in all forms, including protein.
- Protein wasting in kwashiorkor may lead to oedema
- Ascites
- Pleural effusion



Starvation

- **Starvation**
- Starvation is a severe deficiency in caloric energy intake needed to maintain human life. It is the most extreme form of malnutrition.
- In humans, prolonged starvation can cause permanent organ damage and eventually, death.

Incidences

- Criminal (neglected old people and children)
- Natural (CA oesophagus, CA stomach)
- Accidental (mine collapse, ship wrecks)
- Suicidal (Hungers strike, voluntary fast)

Starvation and neglect

- General process

- 40% body weight lose – Life threatening
- Deprivation of water - Kill in abut 10 days
- Total lack of food for 50-60 days – likely to cause death
- Children and elderly are at risk because they are dependent

Death due to starvation and neglect

- History
- Circumstances
  - During autopsy attention should be given to the cause for the starvation such as presence of natural illness or whether there is deliberate withholding of food or neglect.
  - Exclude physical abuse
- External examination
- Internal examination
- Pre autopsy x ray

Post mortem findings

- **External**
- Infants – length and weight is reduced
- General emaciation (Jaw and cheek are prominent, Ribs prominent , scaphoid abdomen, thin limbs)
- Eyes sunken
- Head may appear large

Post mortem findings

- **External**
- Skin is translucent, pale
- Skin dry and wrinkled due to dehydration
- Pressure sores
- Dry brittle hair
- Skin ulcers

Post mortem findings

- **Internal**
- Absence of subcutaneous fat
- Muscle atrophy
- Organ atrophy
- Absent of internal fat (mesentery, epicardium)
- Contracted empty stomach with bile stains
- Intestinal atrophy
- Hard stool
- Distended gall bladder

Opinion

- Starvation as a cause of death or contributory factor
- Contribution of natural illness for starvation
- Contribution of neglect

Summary

- Hypothermia
- Hyperthermia
- Starvation and neglect