Heat Stroke

Heat stroke is a life-threatening condition that can be classified as exertional or non-exertional. This disease is characterized by inadequate hypothalamic thermoregulation and generally occurs when the body's temperature rises above 40 degrees Celsius or 104 degrees Fahrenheit. Clinical features include cutaneous calor and rubor, rhabdomyolysis, a lack of diaphoresis in some cases of non-exertional heatstroke, CNS changes, and acute kidney injury. Management strategies involve external cooling, hydration, and electrolyte correction.



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TYPES

Exertional
Exertional Runner
Exertional heatstroke is a type of heatstroke that occurs more often in young adults. It is commonly caused by intense exercise, especially in hot weather.

Nonexertional
Nun-exertional Runner
Nonexertional heat stroke is a type of heat stroke which often occurs in connection with the underlying diseases.

Characteristics

Inadequate Hypothalamic Thermoregulation
Inadequate Hippo-Thor and Thermometers
The underlying cause of heat stroke is the inability of the hypothalamus to maintain thermoregulation. This can lead to multi-organ failure as many of the body's functions are only able to operate within a narrow range of temperatures. For example, rising temperatures can interfere with enzyme function and oxidative phosphorylation, leading to ischemia and injury.

Body Temperature > 40° C (104° F)
Body Thermometer Greater-than (40) oz.
Severe heat stroke occurs when the body's temperature rises above 40° C.

Clinical Features

Cutaneous Calor and Rubor
Skin-suit-man with Red Hot Skin
Patients with heatstroke will present with cutaneous calor (heat) and rubor (redness). This occurs due to cutaneous vasodilation as the body attempts to lose heat via conduction and radiation.

Rhabdomyolysis
Rabbit-muscle-lights
Rhabdomyolysis is a likely complication of severe heat stroke. Severe increases in body temperature rapidly denature proteins, cause extensive oxidative stress and can lead to ischemia. Muscle tissues that are affected will rapidly break down, releasing creatinine kinase, lactic acid, and electrolytes into the circulation. This process of skeletal muscle breakdown is called rhabdomyolysis.

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No Diaphoresis

No Sweat-Sweatband

In patients with non-exertional heat stroke, anhidrosis, or a lack of sweating, may be seen. In patients with exertional heat stroke, profuse sweating is seen.

CNS Changes

CNS Delta

Neural tissue is extremely sensitive to changes in core body temperature. Additionally, acute hypernatremia due to excessive water loss can impair CNS function. This can lead to altered mental status, seizures, or cerebrovascular events.

Acute Kidney Injury

Acute-angle Kidney-injured

Up to 30% of patients with heatstroke can develop acute kidney injury. This can be due to rhabdomyolysis, electrolyte abnormalities, ischemia, oxidative stress, or DIC.

Management

Rapid External Cooling

Rapid-rabbit External Cooling

As heatstroke is characterized by the failure of the body's innate cooling mechanisms, rapid external cooling is indicated in order to lower core body temperature to safe levels. Cooling measures should be halted at 38 to 39 degrees C to prevent hypothermia.

Hydration

Hydrating with Water

Hydration is crucial in the management of hyperthermia, as the excessive sweating seen in exertional heatstroke is associated with hypotension and volume depletion.

Electrolyte Correction

Electric-lights

Severe electrolyte derangement may be seen in patients with heatstroke. Hypernatremia due to free water loss in sweat, acidosis, and hyperkalemia due to lactate release from muscles, and hypocalcemia may be seen. Patients' electrolyte levels should be measured frequently and corrected.

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