Clinical Practice Guidelines:
Environmental/Hyperthermia

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Purpose	To ensure consistent management of patients with hyperthermia.
Scope	Applies to Queensland Ambulance Service (QAS) clinical staff.
Health care setting	Pre-hospital assessment and treatment.
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Hyperthermia

Hyperthermia results from thermoregulation failure and occurs when the body produces or absorbs more heat than it can dissipate, exceeding the normal limits required to maintain homeostasis. Heat is transferred to and from the body by radiation, conduction, convection and evaporation.[1,2] Extreme hyperthermia (40°C or higher) is a medical emergency and requires immediate treatment to prevent disability or death.

Environmental exposure hyperthermia

Environmental exposure hyperthermia occurs when the body's thermoregulatory mechanisms are overwhelmed through exposure to high environmental temperatures, lack of acclimatisation to hot environments, poor physical fitness or the wearing of excessive amounts of clothing in high temperatures. High humidity is often a contributing factor as it inhibits evaporative cooling from sweat.[3,4]

Intrinsic hyperthermia

Heat is produced internally through chemical reactions of metabolism, skeletal muscles contraction and chemical thermogenesis and can be exacerbated by illnesses or medications, with or without elevation of the patient's internal thermostat including:

- infection *(**Note:** patient may also present hypothermic)*
- malignant hyperthermia
- serotonin syndrome
- neuroleptic malignant syndrome
- anticholinergic syndrome
- status epilepticus
- CVA, involving hypothalamus
- central nervous system infection
- endocrine disorders (e.g. thyroid storm, phaeochromocytoma)
- drug toxicity (e.g. sympathomimetics) or drug withdrawal syndrome (e.g. alcohol).[5–8]

The severity of hyperthermia can be classified into the following:[8]

- ***Heat exhaustion***

  Characterised by a fatigue and a core temperature between 37°C and less than 40°C and is a systemic reaction to heat stress, where the depletion of body fluids and electrolytes occurs without adequate replacement. Heat exhaustion may progress rapidly to heat stroke if left unmanaged.[2]

- ***Heat stroke***

  Characterised by a core temperature of 40°C or higher and an altered conscious state. It is a potentially life-threatening condition that can result in multi-organ failure and death.

Clinical features

Heat exhaustion (core temperature 37°C to less than 40°C)

- severe headache and/or dizziness (especially postural)
- diaphoresis, nausea and vomiting
- tachypnoea, tachycardia, hypotension (especially postural)
- muscle pain, fatigue and cramps.

Heat stroke (core temperature 40°C or higher)

- central nervous system dysfunction (bizarre behaviour, seizures, ALOC)
- extreme fatigue, headache, syncope
- facial flushing, vomiting and diarrhoea
- skin hot, possibly dry or nil diaphoresis
- dysrhythmias and hypotension
- tachypnoea and acute respiratory distress syndrome
- hypoglycaemia and hyperkalaemia

Risk assessment

- Patients can become hypothermic when cooled too rapidly. If the patient begins shivering, becomes cool to touch or peripherally shut down, cooling should be discontinued.
- Avoid the patient shivering as this will increase core body temperature.
- Older persons, children and patients with underlying illness or co-morbidities are at the highest risk.
- Hyperthermia is a medical emergency with the degree and duration being predictors of outcome.

Additional information

- ***Heat exhaustion***

  Management focuses on rehydration, gentle cooling and electrolyte replacement.

- ***Heat stroke***

  The most effective and practical method of actively cooling the patient in the pre-hospital setting is the *'Strip-Spray-Fan-Ice'* method.[1,3,4,7,8] This involves removing all clothing, continuously spraying the patient's skin with water, or pouring tepid water over wet towels that covers the skin and constant fanning or air circulation while ice packs are applied to large superficial blood vessels in the neck, axilla and groin. Combined, this method uses evaporation, convection and conduction to dissipate heat from the body.

- In the pre-hospital setting it is difficult to accurately measure core temperature because tympanic thermometers lack accuracy at temperature extremes.