**EM Basic- Hyperthermia**

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**Normal core body temperature** – 37°C +/- 0.5°C (98.6°F +/- 0.9°F)

**Heat stroke** – core temperature > 40°C (104°F)

* **Exertional** – occurs in athletes/military during strenuous activity
* **Non-exertional (classic)** – occurs in elderly and poor

**Mechanism** – heat load becomes so great that the body’s regulatory mechanisms (ex. evaporation, decreased ability to deliver heat to skin, and impaired vasodilation in elderly) are overwhelmed and can no longer dissipate heat effectively

**History**

**HPI**

Dizziness? Weakness? Nausea/vomiting? Diarrhea? Increased thirst? Profuse sweating? Collapse during strenuous activity?

**Medications** – Pt. on diuretics, antihypertensives, neuroleptics, anticholinergics, dietary supplements?

**PMH** – hx of alcoholism, schizophrenia, or CV disease?

**Setting** **suggesting alternative dx**– symptoms start after general anesthesia? Pt. on antidepressant or antipsychotic medications? History of a thyroid disorder?

**Social** – does pt. use illicit drugs?

**PEARL** – Pts. will often be delirious on arrival to hospital so best history will often be from pre-hospital providers

**Physical Exam**

**Vitals** – tachycardia, tachypnea, hypotension, T > 40°C (104°F)

**Temp. Measurement** – use rectal or esophageal probe

**General** – evaluate muscle compartments for signs of acute compartment syndrome, examine all orifices for bleeding

**Early stages** – neuro signs including delirium, coma, convulsions, hallucinations

**Other signs** – cutenaeous vasodilation, crackles (pulmonary edema), jaundice (hepatic injury), muscle flaccidity, diaphoresis may/may not be present

**PEARL** – A patient with severe exertional heat stroke will usually have muscle flaccidity. If muscle rigidity is instead present, this suggests an alternative diagnosis such as malignant hyperthermia or neuroleptic malignant syndrome.

**Workup**

**CBC** (baseline)

**CMP** (hypoglycemia, hyponatremia, ↑ transaminases, ↑ BUN/creatinine in exertional🡪hypocalcemia, hyperphosphatemia)

**Serum CK/urine myoglobin** (rhabdomyolysis, esp. in exertional)

**Lactate level** (lactic acidosis in exertional)

**ABG/VBG** (metabolic acidosis and respiratory alkalosis common in classic)

**EKG** (dysrhythmias, conduction abnormalities, non-specific ST-T wave changes, heat-related ischemia/infarction)

**Tox screen** (if you suspect medication effect)

**Imaging**

**CXR** (pulmonary edema)

**Head CT/LP** (if you suspect CNS cause of AMS)

**Differential Diagnosis**

**Meningitis/encephalitis** – shaking chills

**Thyroid storm** – enlarged or nodular thyroid gland; order TFTs

**Anticholingeric poisoning** – dilated pupils (constricted in heat stroke)

**Neuroleptic malignant syndrome** – pt. on antipsychotics and p/w hyperthermia, muscle RIGIDITY, AMS, labile blood pressure, tremors, choreoathetosis

**Serotonin syndrome** – pt. on MAOi + SSRI/TCA/opioid; triad of cognitive changes (HA/convulsions), autonomic hyperactivity (tachycardia/diaphoresis), neuromuscular abnormalities (hyperreflexia/myoclonus)

**Malignant hyperthermia** - ↑ core temp. (often > 45°C) after tx w/anesthetic agents, muscle RIGIDITY, sinus tachycardia, skin cyanosis w/mottling

**PEARL** – if there is any diagnostic uncertainty, then sepsis must be considered in differential and empiric broad-spectrum antibiotics should be started

**Management**

**ABCs** – intubation, O2, and fluids as necessary

**Monitoring**

**Vitals –** frequently, rectal/esophageal probe for temp.

**Fluid status/renal function** – Foley catheter

**Other** – cardiac monitor, continuous pulse oximetry

**Cooling (stop when Temp. 38-39°C = 100.4-102.2°F)**

**Ice water immersion (exertional, avoid in elderly/classic heat stroke)**

Place pt. in tub with 2-15°C (35-60°F) cold water

Keep water cool during process and frequently stir

**Evaporative cooling (classic or exertional)**

Removal all of pt.’s clothes and spray pt. with lukewarm water

Position fan towards pt. to blow air over skin and evaporate water

**Water Ice Therapy** (alternative to immersion)

Place patient on a porous stretcher and position over tub of ice water

Ice water taken from bath and continuously poured on patient

Ice packs to massage major muscle groups and ↑ skin vasodilation

If no tub available, can place a few sheets under pt., cover pt.

completely with ice, then wrap him/her with a sheet

**Ice packs** (if ice water techniques or evaporative cooling not possible)

Apply to pt.’s neck, groin, and axillae

**Cold fluid thoracic and peritoneal lavage (last resort)**

Invasive, should never be used in pregnant pt or those with

prior abdominal surgery

**Adjunctive cooling measures**

Cooled O2, cooling blankets, IV fluids cooled to 22°C (71.6°F)

**Disposition**

**Healthy atheletes** – if recover rapidly w/cooling and have no

complications – d/c after period of observation

**Multiorgan dysfunction – admit to ICU**

**All others – admit for observation and monitoring**

**Returning an athlete to play- General Advice**

Avoid significant physical exertion until complete recovery and all

blood tests WNL

Gradual reintroduction of physical activity

May resume full competition after participating in full training in heat

for 2-4 wks w/o adverse effects. NEVER clear an athlete to return to play from the ED- have them followup with another provider as an outpatient.

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