

Severe heat stroke with dyselectrolytemia—Intravascular treatment approach

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Introduction

Heatstroke is a severe heat-related illness that involves an elevation in body temperature greater than 40°C. It is a life threatening condition resulting from prolonged exposure to high temperatures leading to failure of body's thermoregulatory mechanisms. The patient may have clinical signs of central nervous system dysfunction that may include confusion, ataxia, delirium, or seizures that are brought on after strenuous physical exertion or exposure to hot weather.

Case Presentation

A 55 year old male who was known to have hypothyroidism, on regular treatment, reported history of prolonged exposure to heat and inadequate water intake. History of drowsiness in morning followed by loss of consciousness. History of abnormal jerky movements of the upper limbs and lower limbs, Patient's attenders called for ambulance.

On arrival of paramedic, patient's vitals were,

- Heart rate: 140/min
- BP: 140/90mmHg
- SpO₂: 89% on room air
- CBG: 215mg/dl
- GCS: post ictal state
- Temperature: 107°F

Patient was started on 1 gm paracetamol infusion, IV fluids, and nasal oxygen targeting saturation of >94%. Patient was put on left lateral position and shifted to the hospital.

On arrival to the emergency room patients vitals were :

- Heart rate: 120/min
- BP: 130/90mmHg
- SpO₂: 99% with 2Lt O₂
- CBG: 215mg/dl
- GCS: post ictal state
- Temperature: 107°F

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Management in ER

In the ER, during primary survey, patient had another generalised seizure.

In view of recurrent seizure & low GCS, patient was intubated using 8-size cuffed endotracheal tube and connected to the ventilator.

He was treated with Inj.Lorazepam 4 mg and Inj. Levipill 1gm.

Point of care testing revealed the following, ECG showed sinus tachycardia. VBG showed compensated metabolic acidosis with hyposmolar hypovolumic hyponatremia and elevated hematocrit.

Venous Blood gas

pH	7.52
pCo ²	20.2
pO ²	50
BE _{ecf}	-6
HCo ³	16.7
TCO ²	17
sO ²	90%
Lactate	3.88

Lab Investigation

sodium	112 mmol/L
potassium	3.5 mmol/L
chloride	82 mmol/L
i.calcium	0.89 mmol/L
glucose	238 mg/dl
BUN	12 mg/dl
Creatinine	1.2 mg/dl
hematocrit	42%
hemoglobin	14.3 g/dl
anion gap	17 mmol/L

Secondary Management

- ECG showed sinus tachycardia. Patient's initial evaluation showed compensated metabolic acidosis with hyposmolar hypovolumic hyponatremia and elevated hematocrit.
- Patient was immediately started on 2 litres of cold saline infusion after confirming IVC was collapsing using bedside ultrasound. Patient was fully exposed and was wiped down with cold wet towels.

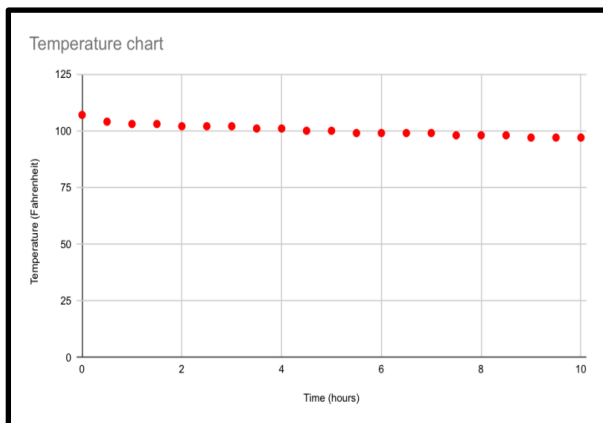


Fig (1.1): Shows how the patient’s temperature was reduced effectively

- Basic blood work up was done. In view of symptomatic hyponatremia, patient was treated with 3%NaCl infusion.

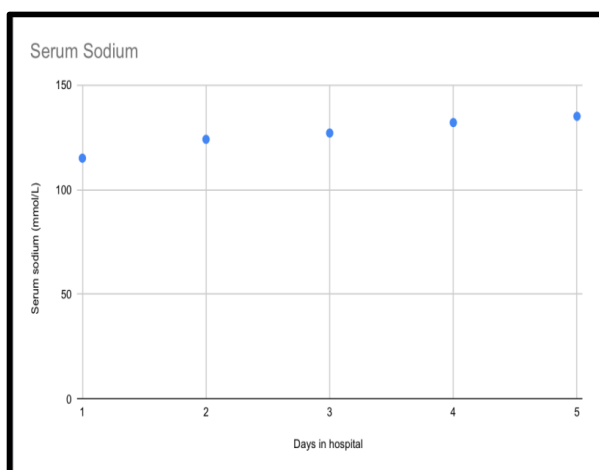


Fig (1.2): Shows how the hyponatremia was corrected not exceeding 8mEq/L in a 24 hr period.

- MRI brain was done and no significant abnormalities were noted.
- After initial stabilisation, patient was shifted to the ICU where cold

saline lavage was done to lower the core body temperature.

- CT- chest revealed subpleural consolidations
- RTPCR for COVID was positive. Counts were elevated . He was started on IV antibiotics.
- Subsequently patient’s GCS improved and was extubated.
- On day 4 patient was shifted to ward and discharged the following day.

Discussion

Heat-related illness is a spectrum of conditions progressing from heat exhaustion, heat injury, to life-threatening heat stroke. The body’s ability to dissipate heat through increased cardiac output, vasoconstriction of splanchnic circulation, and sweating maintain the effective temperature. However, if environmental humidity is above 75%, evaporative cooling begins to become ineffective. Radiation, conduction, and convection do not transfer heat well when the temperature outside the body exceeds the temperature of the skin. Inadequate water repletion may lead to substantial electrolyte abnormalities.

Heat stroke occurs when the body's thermoregulatory mechanisms fail, leading

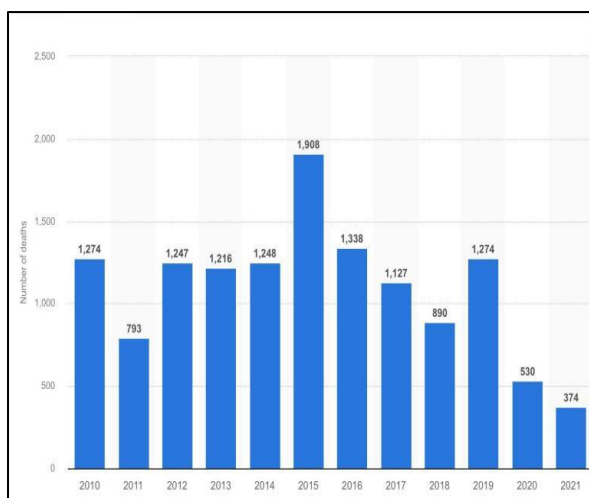
to a dangerous rise in core body temperature.

This can result from prolonged exposure to high environmental temperatures or strenuous physical activity in the heat. The condition can cause cellular damage, systemic inflammatory responses, and multi-organ dysfunction due to the denaturation of proteins, disruption of cell membranes, and activation of inflammatory pathways.

Patients usually present with:

- Elevated core temperature
- Altered mentation
- Absence of sweating

Number of deaths due to heat stroke in India from 2010 to 2021



A heat wave in May 2015 resulted in the highest deaths due to heat stroke and heat related illness.

Always be vigilant of electrolyte imbalances which can potentially lead to rhabdomyolysis and multiple organ dysfunction.

Rapid cooling measures are the cornerstone in management of heat stroke and heat related illness.

Adequate hydration, taking regular breaks, taking advantage of the shade and early recognition of symptoms by proper education and awareness programs are all ways to reduce deaths due to heat stroke.

Conclusion

Heat stroke and heat related illness are medical emergencies and require immediate intervention. Understanding the various symptoms patients can present with, and starting early rapid cooling measures with cooling blankets, cold water immersion, peritoneal lavage, ice packing are all various methods used for rapidly reducing the core body temperature thus enabling better patient outcome.

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