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Heat stroke patients managed in intensive care unit: a case series

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Abstract

Heat stroke is an environmental disease and potentially fatal. It commonly mimics sepsis with shock. We report the cases of patients who developed a severe non-exertional heatstroke with consecutive multiple organ dysfunction. There were different categories of patients with a different course of illness and outcomes. We present a case series of five patients with heat strokes and altered levels of consciousness, highly elevated temperatures, and needing intensive care at our hospital. Most patients were elderly, one had Down's syndrome. All cases had features mimicking sepsis. Patients were treated in the medical intensive care unit (MICU). Low procalcitonin with a negative tropical infection panel made us highly think of heat stroke as a diagnosis.

Keywords: Heat stroke, Hyperthermia, Multiple Organ Dysfunction, Shock

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Introduction

Heat stroke is a clinical constellation of symptoms that include a severe elevation in body temperature which typically, but not necessarily, is greater than 40°C with clinical signs of central nervous system dysfunction that may include ataxia, delirium, or seizures, in the setting of exposure to hot weather or strenuous physical exertion.¹ Heat exhaustion may present similarly and include cramping, fatigue, dizziness, nausea, vomiting, headache and may progress to end-organ damage, i.e. heat injury. Neurologic alteration distinguishes heat stroke from heat injury.

There are two types of heat strokes. Classic heat stroke typically affects the elderly with chronic medical conditions, while exertional heat stroke affects otherwise healthy people who engage in strenuous exercise in hot or humid weather.² Clinically, heat stroke may present as sepsis, requiring aggressive intensive care treatments, and there is growing evidence that endotoxemia and cytokines lead to its pathogenesis.³⁻⁵ Here, we are discussing five different cases of heat strokes managed in MICU.

Case series

Five patients admitted to MICU with high-grade fever, altered sensorium, and organ dysfunction were included. All patients were screened for potential infectious and noninfectious causes of hyperthermia. All patients received treatment according to MICU protocol including sepsis workup, procalcitonin, and tropical infection panel. Temperature control measures like cold sponging and fanning, and bladder irrigation with refrigerated saline were applied to all the patients. Patients were monitored daily with daily relevant investigations. They were followed till discharge or death.

Case 1

A 105 years lady presented to Chitwan Medical College Teaching Hospital Emergency Room (CMCTH ER) with a history of fever, shortness of breath (SOB), and decreased level of consciousness for 2 days. She had a temperature of 102°F, associated with chills and rigors, chest

discomfort, abdominal pain, and restlessness. There was no history of headache, vomiting, burning micturition, and seizure. She was being treated as a case of chronic obstructive pulmonary disease (COPD) and hypertension (HTN). She was under anti-tubercular treatment for the last two weeks as a case of bacteriologically confirmed multi-drug-resistant pulmonary tuberculosis.

At ER, her Glasgow Coma Scale (GCS) was 3/15, heart rate (HR) 87/minute, blood pressure (BP) 60/40 mmHg, temperature 107°F, respiratory rate (RR) 24/minute, oxygen saturation 71%. Random blood sugar was 185 mg/dl. There were no signs of meningeal irritation. She was intubated in the ER, required noradrenaline support and injection hydrocortisone. Central vein catheter was placed.

She was managed in medical intensive care unit (MICU) with temperature control, intravenous fluids and empirical antibiotics. She developed ventricular tachycardia which was managed with injection Amiodarone. Her arterial blood gas (ABG) at ER had metabolic acidosis with severe hyperkalemia (pH 7, K+ 6.5mEq/l, lactate 3) and was managed accordingly. Temperature management was done with cold sponging and fanning, bladder irrigation with refrigerated saline. Even after 8 hours of aggressive management in MICU, the patient expired.

Case 2

A 76 years gentleman, presented to CMCTH-ER with complaints of fever and SOB for 1 day and loss of consciousness for two hours. His maximum recorded temperature was 107°F, associated with rigors. There was no headache, vomiting, seizures, chills, sweating, rashes, burning micturition, abdominal pain or respiratory symptoms.

He was drowsy and decreased responsiveness. He was a known case of COPD and HTN under regular treatment.

In ER, his GCS was 11/15, HR 186 bpm, regular, temperature 106.9°F, RR 48/minute, and BP 116/62 mmHg. Patient was intubated in ER.

He was managed in MICU, and extubated on the third day of intubation. He had acute kidney injury with a creatinine of 2.2 mg/dl which resolved on second day of MICU stay. He also had one episode of seizure on first day of ICU admission managed with injection midazolam. He was managed with mechanical ventilation, sedation with injection Fentanyl and injection Dexmedetomidine. Cold sponging, bladder irrigation with cold saline and injection paracetamol were used to lower temperature. Deep vein thrombosis (DVT) prophylaxis was done. Though he had some ST segment changes in electrocardiogram (ECG), troponin was negative and required no cardiac intervention. After extubating on 3rd day, he was managed with high flow nasal canula. Patient was discharged on 7th day with no any persistent organ dysfunction.

Case 3

A 68 years lady, known case of COPD was brought to CMCTH ER. She presented with high grade fever 104^oF for 3 days and decreased consciousness in form of muttering and not recognizing family members for 1 day. No history of respiratory symptom, seizure and burning micturition. She was taken to nearby hospital where she was intubated and referred to CMCTH.

She was managed in MICU with continued mechanical ventilation, nor adrenaline and hydrocortisone infusion, temperature control measures, and empirical antibiotics. Her sensorium improved on 2nd day of admission and was planned for weaning and extubating next day. Her tropical panel was negative and procalcitonin (PCT) was normal. On day 3rd of admission, her sensorium decreased and did not require sedation. Myocardial infarction and hypothyroidism were ruled out. Liver function tests were deranged and with suspicion of acute liver failure, arterial ammonia was sent. Coagulation was deranged and serum ammonia elevated. Her sensorium did not improve though she was managed in line of liver failure and lab parameters improved. She was taken by family against medical advice on 8th day of admission due to no satisfactory improvement.

Case 4

A 30 years lady, with a diagnosed case of Down's syndrome presented to CMCTH-ER with a history of decreased activity, decreased food intake, and high-grade fever for 2 days. Her maximum recorded fever at home was 103^oF, not associated with chills and rigors but had two episodes of non-projectile vomiting. She also had acute onset shortness of breath and decreased level of consciousness following which she was brought to hospital.

Her measured temperature at ER was 105^oF, BP 70/40 mmHg, HR 120/minute, SPO2 at room air 98% and GCS 8/13. She was managed with intravenous cold ringer's lactate infusion, cold sponging, ice bath, noradrenaline infusion, hydrocortisone infusion, and empirical antibiotics to cover tropical infection according to hospital protocol. Her electrolytes level was corrected. At ER, she had one episode of seizure which was managed with injection Midazolam.

In MICU, she had repeated episodes of seizure which was managed with injection Levetiracetam. Her CPK-NAC was 3942 U/L. It was managed with intravenous fluid hydration and alkaline diuresis. Her serum procalcitonin (PCT) was normal. Tropical infection panel was negative. Thromboprophylaxis and feeding done according to MICU protocol. She had persistent fever and hypotension for four days. She did not improve her communication with family members to her baseline. Her total hospital stay was 13 days. She developed bed sore as complication and she was sent home with Ryle's tube for feeding because her conscious level did not improve much (GCS 11/15).

Case 5

A 62 years lady who used to live alone in a small brick house with small windows and tin roof had a fever for three days. She was found lying unconscious at home by her neighbor. She was taken to a nearby hospital where she was initially managed and her temperature was found to be 104^oF. She was brought to CMCTH ER. At ER, her GCS was 9/15, temperature 104^oF,

BP 90/58 mmHg, HR 114/minute. Family members gave a history of abdominal distention and not passing stool for 2 days. She was resuscitated with intravenous fluid and evaluated for cause of fever. Her underlying dyselectrolytemia (Na^+ 126mg/dl K^+ 3.1 mg/dl) was corrected. Her bedside ultrasound was suggestive of features of intestinal obstruction.

A CT of the abdomen and pelvis suggested features of ileus. However, she passed stool following the enema. Her CT head was normal. Her complete blood count (CBC), bleeding, and coagulation parameters were normal. The tropical fever panel was negative. Liver enzymes alanine transaminase and aspartate transaminase was mildly elevated. Clinically heat stroke was suspected. A creatine kinase (CPK-NAC) initial was 7780U/L which increased to 19,441U/L on third day of admission and gradually decreased on 5th day to 970U/L. She was managed in the medical ICU with antibiotics, intravenous fluids, electrolyte correction, alkaline diuresis and temperature control. She gradually improved and was shifted out of ICU after five days. She was discharged after 8 days.

Discussion

Chitwan and neighboring districts in Terai and mid-hilly regions have hot summer with environmental temperature reaching as high as 42-44°C during May to July (mid-Baishakh to Asar). Fever in critically ill patients may have various etiologies. It usually triggers a multimodal diagnostic workup.⁶

Infectious disease should primarily be ruled out to preclude possible evolution to sepsis, multiple organ dysfunction, and eventual death.⁷ Heat stroke is characterized by the triad of hyperthermia, neurologic abnormalities, and recent exposure to hot weather (classic), physical exertion (exertional), or both.⁸

Classic heatstroke frequently occurs as an epidemic among elderly persons whose ability to adjust physiologically to heat stress has become compromised, chronically ill persons, and those who cannot care for themselves.^{9,10}

Rising global temperatures causing heat waves, as well as urbanizations are the major extrinsic factors.¹⁰

In all cases in this series, we sent investigations to rule out other infective and non-infective causes of hyperthermia. Brain imaging was done as required. In almost all cases we suspected tropical fever and sepsis as initial diagnosis. But the laboratory reports didn't quite support above two. Then the weather, timing of year, degree of raised temperature and profile of patients made us consider heat stroke as diagnosis.

While we lost one patient, and one left hospital with persistent organ damage, we were able to successfully treat two of our patients and discharge with no residual organ dysfunction. One case of Down's Syndrome in our case had bed sore as complication and her neurological status could not improve to her baseline status.

Out of five cases two cases required mechanical ventilation. Among them one was successfully extubated and sent home, while the other could not be extubated due to acute liver failure and hepatic encephalopathy. Two of our patients had significant rhabdomyolysis. The lady of 105 years of age presented with the most severe disease whom we could not salvage.

We did not measure the cytokines level in any patients due to the limitation of our laboratory. Cooling of the patient and organ support as in other critically ill were the main stay of patient management.

Conclusion

Heat stroke is a life-threatening disease requiring immediate admission to an intensive care unit. Timely recognition and intervention including sepsis workup, procalcitonin, and tropical infection panel. Temperature control measures like cold sponging, fanning, and bladder irrigation with refrigerated saline were required to save the patients. Our experience in managing these cases in intensive care unit shows that heat stroke is often unrecognized and under

reported.

Author contribution

Concept, design, planning- all authors (EK, BG, RM); Literature review- EK, BG; Data collection/analysis- PR, PP, SP; Draft manuscript- EK, RM; Final manuscript and accountability of the work- All.

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Conflict of interest

None

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Supplementary material

The data and supplementary material that support the findings of this study are available from the corresponding author upon reasonable request.

Consent

Patient was informed and written consent obtained for the case report in the journal. The patient was counselled that name and initials would not be published and due efforts would be made to conceal the identity, but anonymity cannot be guaranteed.

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