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Mortality from Non-Exertional Heat Stroke Still High in India

A Mohanaselvan, E Bhaskar

Department of
 Medicine, Sri Ram-
 achandra Medical
 College and Research
 Institute, Porur, Chen-
 nai-600116, India



Heat stroke is characterized by hyperthermia, defined as a body core temperature above 40 °C and dysfunction of the central nervous system resulting in delirium, seizures or coma.¹ Case fatality from heat stroke is high, despite lowering body temperature, and survivors may suffer from irreversible brain damage.^{1,2} The spectrum of complications in heat stroke include organ dysfunction involving brain, skeletal muscles, kidney, liver, intestines, lung, pancreas and blood.^{1,3} The first report of death due to hyperthermia dates back to 1946. The first report of death from hyperthermia from India was in 1975.⁴ Indian Meteorological Department reported 1539 deaths in the country due to hyperthermia in 2003.⁴ Despite its common occurrence, there is relatively few data on clinical presentation, laboratory features, and outcome of patients hospitalized for non-exertional heat stroke. We therefore, conducted this study to determine the presentation of patients with the diagnosis of non-exertional heat stroke, who were admitted to our center between May 2012 and May 2013.

Within the study period, 15 (8 male and 7 female) patients fulfilling the diagnostic criteria of non-exertional heat stroke were admitted to our center. Clinical presentation and lab values on admission are presented in Table 1. Ten patients had prior chronic medical illness including diabetes mellitus (n=5), hypertension (n=3), hypo-

thyroidism (n=2), coronary heart disease (n=3), and bronchial asthma (n=1). Two patients had quadriplegia. None had seizures prior to hospitalization. Thirteen patients had serum creatinine kinase levels 4-fold or more than normal value on admission; two had elevated serum creatinine kinase after hospitalization. The patients had serious electrolyte imbalance. Five had severe hyponatremia (<120 mEq/L); six moderate hyponatremia (121–134 mEq/L); and six had hypokalemia (<3.5 mEq/L). Seven had acute kidney injury, defined as serum creatinine >1.4 mg/dL. One had hyperchloremia (serum chloride >110 mEq/L). The mean±SD platelet count in patients was 182 000±120 264 per µL. Four patients had coagulopathy, defined as an international normalized ratio (INR) >1.5 or partial thromboplastin time (PTT) >1.5 times the mean normal value). None had disseminated intravascular coagulation. Proteinuria was present in six patients; none had myoglobinuria or bacteremia.

All of the patients received intensive care and were treated through evaporative body surface cooling that involved applying non-chilled water through mopped gauze over head and neck, trunk and extremities excluding groins. Priority was given to forehead, neck, axilla, thigh, and popliteal fossa. The applied water was left to evaporate with an air conditioning system that kept the air temperature of the pa-

Correspondence to
 Arvindselvan Moha-
 naselvan, MD, Special
 trainee, Department
 of Medicine, Sri
 Ramachandra Medical
 College and Research
 Institute, Porur, Chen-
 nai-600116, India
 Tel: +91-444-592-8578
 E-mail: dr.arvindselvan
 @gmail.com
 Received: Jun 20, 2014
 Accepted: Aug 19, 2014

Cite this article as: Mohanaselvan A, Bhaskar E. Mortality from non-exertional heat stroke still high in India. *Int J Occup Environ Med* 2014;5:222-224.

A. Mohanaselvan, E. Bhaskar

Table 1: Clinical and laboratory characteristics of the studied patients. Figures represent one of mean±SD, mean (range), or number of patients.

Parameter	Survived (n=10)	Expired (n=5)	Total (n=15)
Age (yrs)	51.2±26.4	61.4±12.6	56.6±23.6
Male	5	3	8
Female	5	2	7
GCS score on admission	9	3	8
Peak body core temperature (°C)	41.0 (40.1–42.1)	40.9 (40.2–42.2)	40.9 (40.1–42.2)
Peak CK (IU/L)	21 228±13 600	10 301±9600	17 326±12 540
WBC count (per µL)	13 945±5620	19 754±8862	15 881±6800
Serum creatinine (mg/dL)	1.4±0.9	1.66±0.72	1.48±0.8
Serum Na (mEq/L)	127±14	122±18	125±16
ALT (IU/L)	198±68	231±83	212±74
Arterial blood pH	7.26±0.04	7.22±0.06	7.22±0.05
Bicarbonate (mEq/L)	17.2	18.6	17.6
Metabolic Acidosis			
Normal AG	3	3	6
High AG	5	2	7

GCS: Glasgow Coma Scale, CK: Creatine kinase, WBC: White blood cells, ALT: Alanine transaminase, AG: Anion gap.

tient care area to 22 °C. No fan was used to facilitate evaporation. The cooling method used was very effective and could lower the body temperature to <39 °C in all patients within two hours. None of the patients had persistent pyrexia beyond four hour of admission; there was no recurrence of fever after this period. The patients received intravenous 0.9% saline at a dose of 2.4–4.2 L/day. None of the patients received hypertonic saline. No seizures occurred after hospitalization. Twelve patients received mechanical ventilation. All patients received empirical antibiotic therapy. Five of 15 patients expired, giving a mortality rate of 33%. All patients who expired had admission Glasgow Coma Scale (GCS) score of 3/15.

The mortality rate of 33% in our series is consistent with the average mortality of 40% observed across previous published reports.⁵⁻⁷ Old age, obesity, infection, alcohol consumption, skin disease, decreased physical fitness, and using medications (eg, diuretics, tricyclic antidepressants, antihistamines, and antiparkinson drugs) are considered to be risk factors for non-exertional heat stroke.⁶ None of our patients had any of these risk factors but age >50 years and possible infection. Furthermore, no pathogen was isolated from blood or urine of our patients that made the diagnosis of sepsis unlikely.

Immersion cooling and evaporative cooling are common methods used to lower body temperature in heat stroke.^{5,7}

Our method of evaporative cooling along with treatment on air-conditioned intensive care units, which gives an ambient air temperature of 22 °C without use of fan, appears to be equally effective in lowering body core temperature quickly. The observation that all of our patients on admission or during the first 48 hours had >5-fold increase in serum creatine kinase, makes it a potential inclusion criteria for non-exertional heat stroke.

Of 15 patients studied, 13 had metabolic acidosis, 11 hyponatremia, nine hypokalemia, and seven had acute kidney injury, and 12 needed mechanical ventilation, which were consistent with published reports.⁵⁻⁷ Though thrombocytopenia was present in six and mild coagulopathy in four patients, none had features of disseminated intravascular coagulation, which is reported to occur in 45% of patients in one series.²

We concluded that despite advancements in critical care to manage patients with multi-organ dysfunction, the mortality from non-exertional heat stroke continues to be high in India.

Conflicts of Interest: None declared

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