Heat Stroke: Managing a Tropical Continuum

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Tropical countries are characterised by many clinical conditions both infective and environmental which increase the burden of disease in general population. Some of the infections are related to climate such as malaria, leptospirosis; peaks of which are observed during the monsoon. However, environment exclusively can also be a potential threat to a substantial proportion of the population. The classic example of environment related illness is seen during extremes of temperature. Human metabolic processes are critically temperature dependant. Body's heat production, conservation and loss are controlled by neuronal mechanisms involving the limbic system, lower brainstem, spinal cord and autonomic nerves. Hyperthermia therefore is a potential threat to human life and contributes to morbidity and mortality especially in summer.

Due to temperature extremes in summer in the vast expanses of Gangetic and peninsular India (Uttar Pradesh, Bihar, Orissa, Maharashtra and Andhra Pradesh), heat related illness assumes an important public health dimension. Heat related fatalities occur in thousands in vulnerable population groups such as the very young, the very old and the homeless. A heat wave in 2003 claimed 1600 lives; over thousand of which were lost in Andhra Pradesh alone. An epidemiologic study in the United States estimated the incidence of heat stroke 17.6 - 26.5 per 1,00,000 population. In a similar study in Saudi Arabia the incidence varied from 22 - 250 cases per 1,00,000 population with a crude mortality rate of 50%.

Heat stroke, the most severe form of heat related illness characterised by a core temperature > 40°C and central nervous system abnormalities such as delirium, convulsions or coma. It represents a thermoregulatory failure in which the body temperature rises above the hypothalamic set point because of failure in dissipating mechanisms of the body. Heat stroke can be categorized into two types depending on the cause. Classic heat stroke is non-exertional, environmentally related affecting the very young or very old or people living in poorly ventilated rooms. Outdoor labourers constitute the largest percentage of patients with heat related illness. Patients on medication such as antidepressants and anticholinergics which prevent sweating are also at risk. Exertional heat stroke occurs in the setting of strenuous exercise in young individuals if the ambient temperature and/or humidity is higher than normal.

Progression from heat stress to heat stroke involves a combination of thermoregulatory failure, exaggeration of the acute-phase response and alteration in the expression of heat-shock proteins leading to cascade of metabolic abnormalities and organ dysfunction leading to multiorgan dysfunction syndrome (MODS). Rhabdomyolysis, cardiac dysrhythmias, acute renal failure and coagulopathy ensue and contribute to the high mortality rate.

The goals of treatment are immediate cooling and support of organ system function. Because of large number at risks, effective triage and use of available resources is important. Patients with suspected heat stroke in the community should be stabilized in a cool and shady area before transport to healthcare facility. As seen in other medical conditions there is a golden hour for heat stroke patients.

In general, cooling methods may be external cooling (evaporative and immersion cooling) or internal cooling (gastric or peritoneal lavage). Simple but effective measures are covering with water cooled sheets, icebags over the body especially in the axillae and groin and wet towels and strong fans. In the hospital the most effective method is to immerse the patient in an ice-water tub. Enema with ice-water is a proven modality of treatment. Gastric lavage can also be tried. Laboratory abnormalities that should be anticipated are haemoconcentration, leukocytosis with proteinuria, elevation of blood urea, hypocalcaemia, hypophosphatemia and hypokalemia. Impairment of blood coagulation may occur and patient may manifest with disseminated intravascular coagulation.

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status changes benefit from admission to dedicated hypothermia units (of which few exist) with back up intensive care support. A body-cooling unit is a special bed that sprays atomized water at 15°C and warm air at 45°C over the whole bodysurface to keep the temperature of the wet skin between 32°C and 33°C. Cooling should be continued till a core body temperature of 39°C is reached. Medications such as Dantrolene have been tried but have proved ineffective in reducing core body temperature. However, recent data from studies in rats suggests a beneficial role of ipsapirone and ketanserin in treatment. Aggressive management of patient with MODS may be required, in comatose patient with severe respiratory and metabolic acidosis, intubation and ventilatory support may be needed. Hydrocortisone helps in correcting shock, cerebral edema and adrenal insufficiency. Adequate urine output (50 ml/hour) should be maintained with aggressive hydration and loop diuretics and mannitol. Persistent oliguria is an indication for dialysis.

As always, prevention is better than cure and effective public health education can help prevent most of the cases of heat stroke. Physicians should encourage people to acclimatize to the heat, wear loose clothing, drink plenty of water, consume salty food and avoid exertion during hotter periods of the day. Improved weather forecasting and adequate warning systems in place warn the population at risk. Establishment of community shelters and visiting nurses for the poor and disadvantaged helps save previous lives.

To conclude, the basic instruction to the general public on do’s and don’ts in prevention of heat stroke through the Directorate of health services is the first important step. Compulsions of livelihood may force individuals to work outdoors under vulnerable conditions. Public health officials should focus greater attention on prevention and physicians should be knowledgeable in the altered physiology and hemodynamics for a prompt and effective multipronged strategy to tackle the scourge of heat related illness.

REFERENCES