Heatstroke is a medical emergency that leads to elevated mortality and morbidity. Although heatstroke was first documented in the year 24 BC by the Romans, the fact that it could result in multiorgan dysfunction was not demonstrated until 1946. In fact, although heat-related illnesses are known since Biblical times, they are seldom addressed as a medical or health catastrophe in our society. Heatstroke is described as a form of hyperthermia combined with a systemic inflammatory response, converging into a multiorgan dysfunction syndrome in which encephalopathy predominates. The clinical definition of heatstroke is a core body temperature in excess of 40°C, accompanied by dry skin, and central nervous system dysfunction (confusion, delirium, coma or seizures). It appears that hyperthermia is instrumental in opening of the blood-brain barrier either directly or indirectly leading to vasogenic oedema formation, a feature crucial to molecular and cellular alteration in the brain inducing cell and tissue injury. Laboratory tests may reveal acute renal failure, coagulation disorders, metabolic acidosis, respiratory alkalosis, acute hepatic necrosis, rhabdomyolysis, hypoelectrolytaemia and leukocytosis. Resulting from exposure to environments of high temperature and humidity, heatstroke is classified as one of two types. Exertional heatstroke is common in physically active individuals, and nonexertional (classic) heatstroke may affect persons with underlying medical conditions that impair thermoregulation. Notably, Zhou and colleagues reported two cases of fatal heatstroke caused by overheating from electric blankets in winter. Moreover, social precariousness and poor general health, such as being confined to bed, unable to adequately care for self or to leave home daily, or having a pre-existing cardiovascular, pulmonary, or psychiatric disorder, are notably linked to death during a heat wave.

The World Health Organization (WHO) estimates that the warming and precipitation trends due to anthropogenic climate change of the past 30 years already claim over 150,000 lives annually. According to the Centers for Disease Control and Prevention, there were 8015 heat-related deaths in the United States between 1979 and 1999. A total of 3829 (48%) were “due to weather conditions,” 377 (4%) were “related to artificial heat sources” (e.g., furnace rooms, boiler rooms, vehicles, factories, and kitchens), and 3809 (48%) were “of unspecified origin.” In addition, the heat wave that affected Europe during the summer of 2003 led to 22,000 to 45,000 excess deaths. Heatstroke occurs in epidemic form during heat waves, and both hospital emergency department visits and intensive care unit admissions increase sharply. Health care professionals should be effectively prepared to promptly recognize and treat this critical medical condition. However, heatstroke has typically been overlooked and unexplored in Brazil as a potential aetiological factor in patients with elevated core body temperature and disturbances of the central nervous system. In fact, cases of heatstroke can be misdiagnosed or underreported in Brazil because neither the general public nor health care professionals have sufficient knowledge of this overpowering heat illness. We recently reported the first documented occurrence of human heatstroke in Brazil. However, our initial misunderstanding of the true nature of this clinical profile leads to a mistaken highlighting on “supportive therapy” as the appropriate cooling procedures were not carried out. Therefore, physicians must be alert to the possibility of heatstroke when a patient presents with the clinical and epidemiological features described above, especially if the patient is engaged in heavy labour or sports during heat waves.

In many clinical and pathogenic aspects, heatstroke resembles sepsis, requiring aggressive intensive...
care treatments, and there is growing evidence that cytokines are implicated in its pathogenesis. Heatstroke induces both local and systemic production of cytokines. Cytokines act as key messengers for several cells within the vascular tree and the central nervous system compartment. In fact, these critical molecular messengers are involved in the genesis of a constellation of human pathophysiological phenomena: stroke, pericarditis, peritonitis, toxoccelism, meningitis, sepsis, coagulation disorders, myocardial dysfunction, and circulatory collapse. Furthermore, the morbidity and mortality rates of heatstroke are correlated with cytokine levels.

In several forms of systemic inflammatory response syndrome (SIRS), such as in heatstroke, the presenting clinical symptoms and outcome have been predicted by the concentration of procalcitonin. demonstrated that the patients who survived, had a significantly higher procalcitonin concentration on admission (>0.5 ng/ml) than those patients who died of classic heatstroke. The potential underlying cause of hiperprocalcitoninaemia is linked to cytokine network pathway. The cytokine signalling networks may play a role in the activation of inflammatory cells from the bloodstream and these monocytes/macrophages are in turn responsible for procalcitonin release.

A systematic review of the literature failed to identify reliable clinical data on the optimum treatment of heatstroke. Nowadays, immediate cooling continues to be the keystone of the successful management of this dramatic illness, reducing morbidity and mortality rates. In addition, supportive measures to maintain homeostasis, including electrolyte replacement, fluid reposition, vitamin K administration, and transfusion of fresh-frozen plasma, as necessary, in a timely fashion.

In summary, with the documented increase in average global surface temperatures of 0.6°C since 1975, there is now uniform agreement in the international scientific community that the earth is warming from a variety of climatic effects, most notably the cascading effects of greenhouse gas emissions to support human activities. In addition, global average temperatures are projected to increase between 1.4 and 5.8°C by the end of this century, and global warming is already causing heat waves in temperate climates. Sophisticated climate models predict increasing frequency and severity of heat waves, and most cities show a large heat island effect, registering 5-11°C warmer than surrounding rural areas. In fact, the worldwide threat of heatstroke is drastically rising. Therefore, identifying risk groups for contracting or dying from heatstroke is a key step toward devising better prophylactic measures and maximising patient care. Only with scientific knowledge of the early clinical clues and epidemiological features of this catastrophic illness can the health care workers develop major surveillance tools. Finally, we also highlight an unexplored and overlooked life-threatening illness on the map of research and surveillance in Brazil. Nevertheless, success in this endeavour is critically dependent on availability of the appropriate surveillance tools and cooling therapies.

Alexandre Leite de Souza
Intensive Care Unit
Emilio Ribas Institute of Infectology
São Paulo, Brazil
For correspondence:
Rua da Consolação
2270 Ap 304, CEP 01302-001
São Paulo, SP, Brasil
alexandrelouzej@gmail.com

References