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CASO CLÍNICO

Hyperthermia in a Teenager: Is it Just a Heat Stroke?

Hipertermia num Adolescente: Será Apenas Golpe de Calor?

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ABSTRACT

An adolescent male with obesity and autism spectrum disorder presented to the emergency department with acute confusion, chills, muscle rigidity, and severe hyperthermia (tympanic temperature 41.9ºC) after physical exertion in extreme heat. His regular medication included antipsychotics. Laboratory evaluation showed multiorgan dysfunction, supporting a diagnosis of heat stroke with concurrent neuroleptic malignant syndrome. Prompt resuscitation and external cooling were initiated, and the patient was admitted to the pediatric intensive care unit. Management included discontinuation of antipsychotics, dantrolene and bromocriptine, active temperature control using Criticool®, benzodiazepines, and aggressive intravenous fluid therapy. The patient improved gradually and was discharged after four days in intensive care and 14 days in the ward, on aripiprazole and clonidine. This case highlights the diagnostic and therapeutic challenges posed by severe hyperthermia with overlapping features of heat stroke and neuroleptic malignant syndrome.
Keywords: Adolescent; Heat Stroke; Hyperthermia/etiology; Neuroleptic Malignant Syndrome

RESUMO

Um adolescente do sexo masculino, com obesidade e perturbação do espetro do autismo, recorreu ao serviço de urgência por início agudo de confusão, calafrios, rigidez muscular e hipertermia grave (temperatura timpânica 41,9ºC), após esforço físico sob calor extremo. A medicação habitual incluía antipsicóticos. A avaliação laboratorial revelou disfunção multiorgânica, sugerindo diagnóstico de golpe de calor concomitante com síndrome neuroléptica maligna. Foram iniciadas medidas de suporte avançado de vida e arrefecimento externo, com transferência para unidade de cuidados intensivos pediátricos. A abordagem incluiu a suspensão da terapêutica antipsicótica, administração de dantroleno e bromocriptina, controlo ativo da temperatura com recurso a Criticool®, benzodiazepinas e fluidoterapia intravenosa agressiva. Verificou-se uma melhoria progressiva, com alta após quatro dias de cuidados intensivos e 14 dias de internamento em enfermaria, mantendo a terapêutica com aripiprazol e clonidina. Este caso destaca a complexa interação entre o calor extremo e a síndrome neuroléptica maligna, evidenciando os desafios diagnósticos e terapêuticos associados.
Palavras-chave: Adolescente; Golpe de Calor; Hipertermia/etiologia; Síndrome Maligna dos Neurolépticos

INTRODUCTION

Hyperthermia is defined as an abnormal elevation in core body temperature, resulting from an imbalance between heat production and heat dissipation.[1,2] Prolonged hyperthermia can lead to cellular injury, multiorgan dysfunction, and death.[3] Several life-threatening syndromes are associated with extreme hyperthermia, including heat stroke (HS) and neuroleptic malignant syndrome (NMS). These conditions may share overlapping clinical features, making differentiation challenging.

Heat stroke, the most severe form of heat-related illness, is characterized by a core temperature exceeding 40°C following central nervous system dysfunction.[4] It is classified into exertional and non-exertional (classic) forms, depending on the source of heat exposure.[5] Heat-related illnesses remain a significant public health concern, with mortality rates reaching up to 80% in severe cases; however, most deaths are preventable with early recognition and prompt management during extreme heat events.[6]

Neuroleptic malignant syndrome is a rare, idiosyncratic emergency, diagnosed according to DSM-5 criteria, which include recent exposure to dopamine receptor antagonists, severe muscle rigidity, hyperthermia, and at least two additional features such as altered mental status, dysautonomia, or elevated creatine kinase levels (CK).[7-12] It has been associated with nearly all antipsychotic agents (reported incidence 0.01% - 3.2%), particularly first-generation neuroleptics as well as other drugs that interfere with central dopaminergic pathways.[11,12] Although most cases occur in young adults, this likely reflects initial exposure to neuroleptic agents rather than an age-specific increased susceptibility.[9,10] This case highlights the diagnostic and therapeutic challenges of severe hyperthermia with overlapping HS and NMS features.

CASE REPORT

A 16-year-old male patient under child welfare care, with morbid obesity and autism spectrum disorder, receiving paliperidone 9 mg once daily, topiramate 50 mg twice daily, chlorpromazine 100 mg three times daily, fluoxetine 20 mg once daily, and diazepam as needed, presented with acute altered mental status and neuromuscular symptoms, without recent

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medication changes. Symptoms developed immediately after uphill exertion in high ambient temperatures and progressed to altered speech, loss of consciousness, and generalized tremors. The temporal association with exertion supported exertional heat stroke (HS); however, persistent muscle rigidity in the context of antipsychotic use raised suspicion of concomitant neuroleptic malignant syndrome (NMS).

On admission, he was tachycardic (200 bpm), normotensive (115/65 mmHg), and hyperthermic (41.9°C), with altered consciousness (Glasgow coma scale 13), generalized tremors, and marked rigidity. Initial management included immediate discontinuation of antipsychotics, external cooling, intravenous fluids, ceftriaxone, and paracetamol.

The laboratory evaluation revealed multiorgan dysfunction, including respiratory failure requiring non-invasive ventilation, coagulopathy (INR 2.4, platelets 50 000/μL), acute kidney injury (creatinine 1.73 mg/dL), marked transaminase elevation (ALT 3463 U/L, AST 1794 U/L), and rhabdomyolysis (CK 3262 U/L). C-reactive protein was elevated (2 mg/dL). Cardiac evaluation showed sinus tachycardia, and additional investigations (brain computed tomography, toxicology screen, and blood cultures) were unremarkable.

Temperature control required 24 hours of active cooling with a Criticool® system, in combination with dantrolene, bromocriptine, benzodiazepines, and aggressive intravenous hydration. After four days in the pediatric intensive care unit, the patient improved and was transferred to the ward. Over the subsequent 14 days, he underwent physical and respiratory rehabilitation, gradual tapering of bromocriptine, full psychiatric and social assessment, and on day 11 started aripiprazole and clonidine. He was discharged after an 18-day hospitalization on aripiprazole, clonidine, and lorazepam, with multidisciplinary follow-up in psychiatry and pediatrics. At the three-month follow-up, he showed complete clinical and biochemical recovery (CK 244 U/L, urea 39 mg/dL, creatinine 0.9 mg/dL, AST 42 U/L, ALT 81 U/L), with no sequelae.

DISCUSSION

Hyperthermia has a broad differential diagnosis, including heat-related, toxicological, infectious, and neurological causes. In this case, HS was the leading working diagnosis, based on exertional exposure in high ambient temperatures, altered mental status, and a core temperature of 41.9°C.[4] Neuroleptic agents are known to impair thermoregulation and increase susceptibility to hyperthermia, thereby predisposing to heat stroke.[8] Given chlorpromazine use, NMS was also considered, as the patient fulfilled diagnostic criteria including hyperthermia, muscle rigidity, altered mental status, and autonomic dysfunction.[7,11,12] Accordingly, antipsychotic therapy was discontinued. Empirical ceftriaxone was initiated to cover potential central nervous system or systemic infection while microbiological studies were pending. Elevated inflammatory markers were interpreted as nonspecific, as they may reflect the systemic inflammatory response associated with both HS and NMS. Toxic and infectious etiologies were excluded by negative toxicology screening and blood cultures, and central nervous system primary disease was unlikely given a normal cranial CT scan. Serotonin syndrome was also considered because of fluoxetine use; however, the absence of clonus and hyperreflexia made this diagnosis less likely.[13]

Survivors of HS often develop hepatic enzyme elevation, acute kidney injury, and disseminated intravascular coagulation.[14] Neuroleptic malignant syndrome is typically associated with substantial creatine kinase elevation, which in our patient exceeded 3000 U/L; leukocytosis and laboratory evidence of dehydration may also be present.[9,10,15]

The coexistence of features consistent with both exertional HS and NMS highlights a clinically important overlap that requires a high index of suspicion and early parallel management, including withdrawal of offending agents and aggressive supportive care.[3,8]

In our case, management included immediate withdrawal of neuroleptics, aggressive cooling with active temperature management, and supportive care, including non-invasive ventilation and correction of fluid and electrolyte disturbances. Given concern for NMS, dantrolene was administered, as it acts on peripheral skeletal muscle and may be useful in severe NMS presenting with extreme rigidity and fever.[8,9,11] Dantrolene is not recommended as first-line therapy for HS because the supporting evidence is limited, although it may be considered in selected cases with evidence of ongoing endogenous heat production (*e.g.*, marked muscle rigidity or shivering) as an adjunctive measure.[1,16]

After NMS, antipsychotic rechallenge should be delayed for at least two weeks because recurrence may occur in up to 30% of cases, requiring close surveillance.[17] This case illustrates that medication-induced disruption of thermoregulation can precipitate severe heat stroke, especially in vulnerable pediatric patients. The concomitant features of NMS emphasize the need for a high index of suspicion, as diagnostic uncertainty may delay targeted treatment and compromise outcomes.

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AUTHOR CONTRIBUTIONS

ML: Study conception and design, drafting of the manuscript.
LC, CC, ET, SD: Study conception and design, critical review of the manuscript.
All authors approved the final version to be published.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in October 2024.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

PARENTAL CONSENT

Obtained.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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