Extracorporeal Blood Purification in Heatstroke

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Background

- Heatstroke is a condition caused by the body overheating due to exposure to strenuous physical activity in hot environment. It is a condition that requires emergency medical care as it can damage multiple organ including the brain, heart, kidneys and muscles.
- We reported a case of a 25-year-old man with exertional heatstroke and multi-organ failure.

Objective

- To describe extracorporeal support in patient with heatstroke.

Methods

- We obtained data of a case with heatstroke treated with CVVHDF and hemoadsorption for cytokines removal.

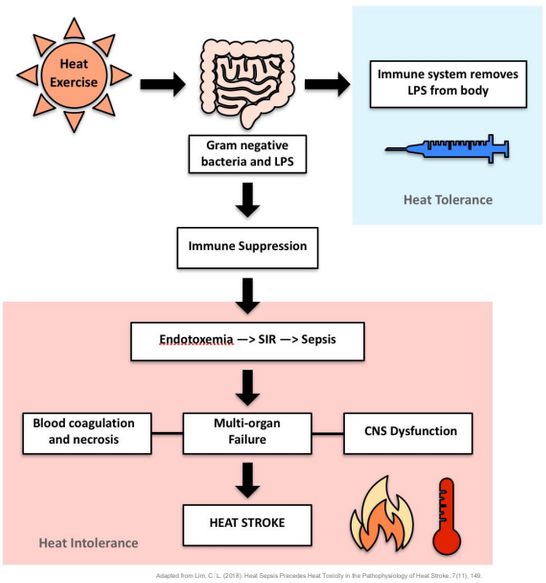
Case Report

- A Thai 25-year-old male presented with a history of fever, diarrhea, and sudden loss of consciousness while training in a military program. His core temperature reached 41 degrees Celsius with a Glasgow Coma Scale of 6/15. The patient was intubated at scene and brought to the ER, upon arrival he had received multiple cooling procedure aimed to lower his core temperature and his core temperature was lowered to 38 degree Celsius. The CT scan of his brain revealed no acute infarction or hemorrhage.
- His blood pressure dropped despite aggressive volume resuscitation with crystalloid and the vasopressor had to be added, norepinephrine dosage of 0.15 mcg per kilograms per minute was required to maintain his blood pressure. Later on, his laboratory revealed severe rhabdomyolysis and acute kidney injury AKIN stage 3. His creatinine kinase level peaked at 77,006 U/L on day 2 of admission and also lactic acidosis with ischemic hepatitis. The patient also received antibiotics empirical for bacterial infection and continuously received organ cooling procedure.
- After the clinical worsening, he needed support with Continuous Veno-Venous Hemodiafiltration (CVVHDF) starting from day 2 of admission. Furthermore, to deal with the inflammation he was also treated with HA330, a hemoperfusion adsorbent for 6 hours per day during day 2-6 of admission. Vasopressor was taper off after 72 hours but the CRRT continued for 15 days due to hyperkalemia and volume adjustment.

Case Report

- The patient then switched to intermittent hemodialysis and weaned off from dialysis support on day 26 of admission. His renal function was fully recovered and his creatinine level had reached its baseline at day 34 of admission. His overall condition improved despite the complication of ventilator-associated pneumonia, which was treated with antibiotics.
- He was extubated on day 37 of admission and was discharged from hospital on day 79 after receiving rehabilitation until he was able to walk with support.

Discussion



Adapted from Lim, C. L. (2018). Heat Sepsis Precedes Heat Toxicity in the Pathophysiology of Heat Stroke, 7(11), 149.

- Exertional heatstroke is rather common among young adults who was exposed to strenuous physical activity in high temperature environment. The pathophysiology relies on failure of thermoregulatory response which causes an insufficient cardiac output to cope with the needs. Hyperthermia triggers a stress response involving the release of pro-inflammatory cytokines, leading to excessive activation of leukocytes and endothelial cells. The heatstroke also reduces intestinal blood flow resulting in the damage of cell membrane, allowing endotoxins and pathogens leaking into systemic circulation.
- The standard treatment consists of effective cooling methods and supportive of internal organ injury. As mentioned, the process of heat stroke involves cytokines and endotoxin, causing rhabdomyolysis and acute kidney injury requiring dialysis.
- Therefore the process of treating the patient with renal replacement therapy mode CVVHDF with hemoperfusion adsorbent might reduce systemic inflammation and help with the patient condition.

Conclusion

"Hemodiafiltration and hemoadsorption may effectively improve the clinical outcome in heatstroke patients."

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