

A Lightning Strike Mimic: The Abusive Use of Dog Shock Collar Presents as Encephalopathy, Respiratory Arrest, Cardiogenic Shock, Severe Hyponatremia, Rhabdomyolysis, and Multiorgan Injury

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Abstract : A 3 year old male with unknown medical history presented initially with encephalopathy, intubated for respiratory failure, and admitted to the pediatric intensive care unit (PICU) with refractory shock. During resuscitation in the emergency department, he was found to be in severe metabolic acidosis with a pH of 7.03 and escalated on vasopressor drips for hypotension. His initial sodium was 174. He was noted to have burn injuries to his scalp, forehead, right axilla, bilateral arm creases and lower legs. He had rhabdomyolysis (initial creatinine kinase 5,430 U/L with peak levels of 62,340 normal <335 U/L), cardiac injury (initial troponin 88 ng/L with peak at 145 ng/L, normal <15ng/L), hypernatremia (peak 174, normal 140), hypocalcemia, liver injury, acute kidney injury, and neuronal loss on magnetic resonance imaging (MRI). Soft restraints and a shock collar were found in the home. He was critically ill for 8 days, but was gradually weaned off drips, extubated, and started on feeds. Discussion Electrical injury, specifically lightning injury is an uncommon but devastating cause of injury in pediatric patients. This patient with suspected abusive use of a dog shock collar presented similar to a lightning strike. Common entrance points include the hands and head, similar to our patient with linear wounds on his forehead. When current enters, it passes through tissues with the least resistance. Nerves, blood vessels, and muscles, have high fluid and electrolyte content and are commonly affected. Exit points are extremities: our child who had circumferential burns around his arm creases and ankles. Linear burns preferentially follow areas of high sweat concentration, and are thought to be due to vaporization of water on the skin's surface. The most common cause of death from a lightning strike is due to cardiopulmonary arrest. The massive depolarization of the myocardium can result in arrhythmias and myocardial necrosis. The patient presented in cardiogenic shock with evident cardiac damage. Electricity going through vessels can lead to vaporization of intravascular water. This can explain his severe hypernatremia. He also sustained other internal organ injuries (adrenal glands, pancreas, liver, and kidney). Electrical discharge also leads to direct skeletal muscle injury in addition to prolonged muscular spasm. Rhabdomyolysis, the acute damage of muscle, leads to release of potentially toxic components into the circulation which could lead to acute renal failure. The patient had severe rhabdomyolysis and renal injury. Early hypocalcemia has been consistently demonstrated in patients with rhabdomyolysis. This was present in the patient and led to increased vasopressor needs. Central nervous system injuries are also common which can include encephalopathy, hypoxic injury, and cerebral infarction. The patient had evidence of brain injury as seen on MRI. Conclusion Electrical injuries due to lightning strikes and abusive use of a dog shock collar are rare, but can both present in similar ways with respiratory failure, shock, hypernatremia, rhabdomyolysis, brain injury, and multiorgan damage. Although rare, it is essential for early identification and prompt management for acute and chronic complications in these children.

Keywords : cardiogenic shock, dog shock collar, lightning strike, rhabdomyolysis

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