An Unlikely Cause of Paralysis

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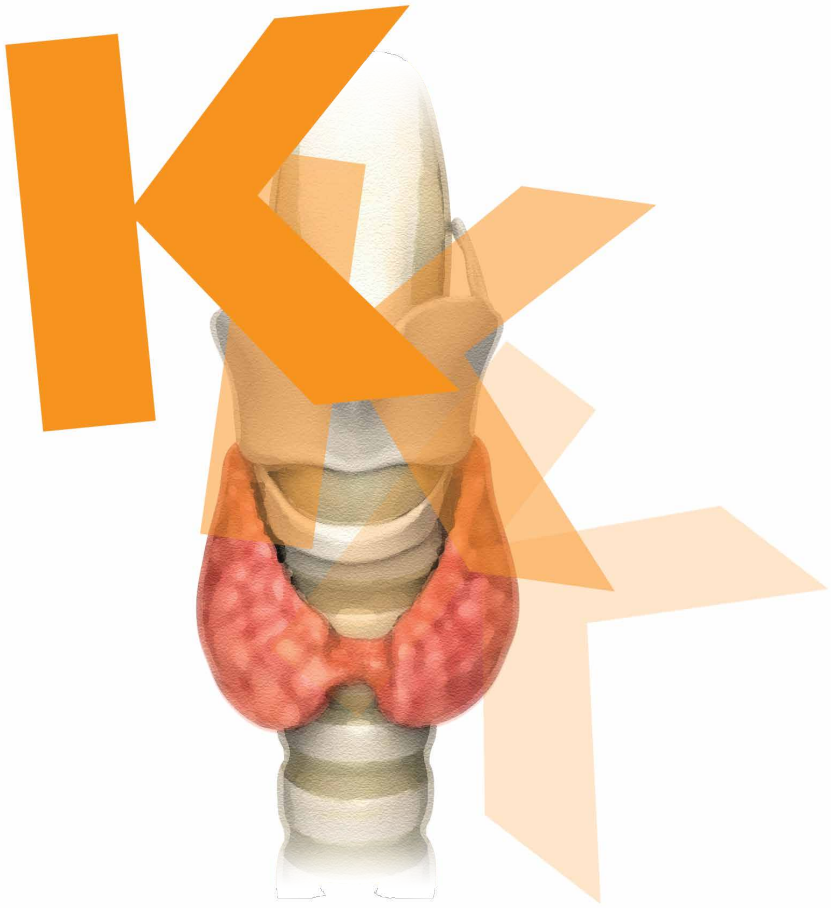
A young man with a history of hypertension and hyperlipidemia presented for evaluation of severe bilateral weakness in the upper and lower extremities.

Case

An Asian man in his third decade, with a medical history of hypertension and hyperlipidemia, and who had recently been involved in a motor vehicle collision (MVC), presented to the ED with a chief complaint of severe bilateral upper and lower extremity weakness. The patient noted that the weakness had begun the previous evening and became progressively worse throughout the night, to the point that he was unable to move any of his extremities on the morning of presentation.

Upon arrival at the ED, the patient was awake, alert, and oriented to self, time, and place; he also spoke in full sentences without distress. He denied fever, chills, difficulty breathing, or preceding viral illness. The patient stated that he was not taking any medications and denied a history of alcohol, tobacco, or drug abuse.

Initial vital signs at presentation were: blood pressure, 141/50 mm Hg; heart rate, 90 beats/min; respiratory rate, 16 breaths/min; and temperature, 97.4°F. Oxygen saturation was 100% on room air. On physical examination, the patient was in no acute distress and had a normal mental



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status. His pupils were normally reactive and his other cranial nerves were normal. Muscle strength in the upper and lower extremities was 1/5 with 1+ reflexes bilaterally, and there was no sensory deficit. The patient was placed on continuous cardiac monitoring with pulse oximetry.

What is the differential diagnosis for acute extremity weakness or paralysis?

The differential diagnosis for acute symmetrical extremity weakness or paralysis is broad and includes conditions of neurological, inflammatory, and toxic/metabolic etiologies.[1] Neurological diagnoses to consider include acute stroke, specifically of the anterior cerebral or middle cerebral artery territories; Guillain-Barré syndrome; myasthenia gravis; spinal cord compression; and tick paralysis. Acute ischemic or hemorrhagic stroke most frequently presents with unilateral upper or lower extremity weakness accompanied by garbled speech and sensory deficits. Patients who have suffered a brainstem or cerebellar stroke commonly present with alterations of consciousness, visual changes, and ataxia. Posterior circulation strokes are also characterized by crossed neurological deficits, such as motor deficits on one side of the body and sensory deficits on the other.

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Spinal Cord Pathology. Signs and symptoms of spinal cord compression or inflammation vary widely depending on the level affected. Motor and sensory findings of spinal cord pathology include muscle weakness, spasticity, hyper- or hyporeflexia, and a discrete level below which sensation is absent or reduced.

Guillain-Barré Syndrome. Patients who have Guillain-Barré syndrome (a disease of the myelin sheaths of the peripheral nerves) often present with complaints of numbness or paresthesias in the extremities.[2] The condition is characterized by progressive symmetric muscle weakness accompanied by absent or depressed deep tendon reflexes and is typically associated with a recent exposure to an infectious agent such as a viral upper respiratory infection, bacterial infection, or vaccine.

Myasthenia Gravis. Myasthenia gravis is a disease of the neuromuscular junction. It presents with weakness in any muscle group, and the muscles are easily fatigued by repetitive use.

Toxic Exposures. Toxins, such as botulinum, ixovotoxin, nicotine, succinylcholine, and tetrodotoxin, are prominent, though less common, causes of muscular weakness or paralysis. Botulinum toxin acts at the neuromuscular junction. Patients with botulism typically present with a gastrointestinal prodrome of nausea, vomiting, and diarrhea followed by cranial nerve dysfunction and descending muscle weakness.[3]

Tetrodotoxin, nicotine, and curare-like paralytics act at the motor end plate of the neuromuscular junction to produce neuromuscular blockade with subsequent muscular weakness or paralysis. Similarly, ixovotoxin, the toxin responsible for tick paralysis, causes ascending flaccid paralysis by decreasing the release of acetylcholine at the neuromuscular junction.[3]

Metabolic and Endocrine Disorders. Conditions such as hypokalemia, hypomagnesemia, and periodic paralysis can also present with neurological complaints such as generalized weakness and paresthesias. Of note, it is important to differentiate true neuromuscular weakness from weakness secondary to limited effort.

Case Continuation

Because of the patient's history of an MVC, cervical cord compression was consid-

ered concerning enough to require exclusion through magnetic resonance imaging (MRI) of the cervical spine. However, upon arrival at the MRI suite, the patient became severely tachypneic and tachycardic, and was unable to tolerate lying flat. He was intubated for impending respiratory failure. Laboratory results from blood drawn prior to transport to MRI were reported immediately after the resuscitation and were notable for the following: potassium, <1.5 mEq/L; bicarbonate, 20 mEq/L; creatine kinase, 889 U/L; ethanol, not detected.

What is hypokalemic periodic paralysis?

Hypokalemic periodic paralysis (HypoKPP) is a syndrome of episodic muscle weakness with concomitant hypokalemia. Familial forms of HypoKPP have been attributed to mutations in genes coding for either calcium or sodium channels.

The nonfamilial form of HypoKPP is attributed to hyperthyroidism and is most often seen in Asian men in the second and third decades of life. The disorder is characterized by acute onset hypokalemia and extremity paralysis with simultaneous hyperthyroid state. It is believed that hypokalemia occurs as a result of intracellular shift of potassium from thyroid-induced hormone sensitization of the Na^+/K^+-ATPase rather than a depletion of total body potassium. Acute episodes of paralysis are triggered by high-carbohydrate meals, alcohol consumption, emotional stress, and infection. Paralysis can last from 3 to 96 hours and is accompanied by decreased or absent deep tendon reflexes with normal sensation and mental status.

In the nonfamilial form of HypoKPP, signs of thyrotoxicosis are often present and include tachycardia, moist skin, and hyperthermia, but it may be difficult to specifically recognize this etiology given the patient's grave clinical condition.[4] Similar to many significant metabolic and electrolyte disturbances, complications of HypoKPP include dysrhythmia, respiratory failure, and sometimes death.[5]

How should HypoKPP be managed in the ED?

Management of HypoKPP begins with careful assessment of the patient's airway, breathing, and circulation. Once the patient is stabilized, management of consequential effects of hypokalemia, such as respiratory distress and muscular paralysis, should focus on correcting the electrolyte and endocrine derangements.

Propranolol. If the patient exhibits signs of thyrotoxicosis, initial treatment includes propranolol, a nonselective beta-blocker, which both prevents the intracellular shift of potassium and assists in correcting the underlying hyperthyroid and hypermetabolic state. Although there is no standard propranolol dosing protocol for HypoKPP, some authors suggest that an aggressive dose of 2 mg intravenously (IV) every 10 minutes can shorten the patient's episode of paralysis to 6 hours.[6]

Potassium Chloride. Administration of potassium chloride to raise the serum potassium to life-sustaining concentrations should be done cautiously through IV infusion of standard doses.[7] In correcting hypokalemia with potassium, care should be taken to avoid overcorrection, which may subsequently result in rebound hyperkalemia as the total body potassium redistributes. Lower doses of potassium (ie, <50 mEq per dose), are preferred to achieve adequate repletion while avoiding rebound hyperkalemia.[8]

Case Conclusion

The results of thyroid studies that had been added on to the original set of laboratory studies revealed profound hyperthyroidism, with an essentially absent concentration of thyroid-stimulating hormone.

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