Case report

Hypokalemic periodic paralysis: a case report.

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Abstract:

Hypokalemic periodic paralysis (HKPP) is a rare genetic disorder with autosomal dominant inheritance and characterized by recurrent attacks of skeletal muscle weakness with associated hypokalemia which is precipitated by stress, cold, carbohydrate load, infection, glucose infusion, hypothermia, metabolic alkalosis, anesthesia and steroids. Hypokalemic Periodic Paralysis is one form of Periodic Paralysis, a rare group of disorders that can cause of sudden onset weakness. A case of a 29 year old male is presented here. The patient presented with sudden onset paralysis of his extremities. Laboratory evaluation revealed a markedly low potassium level. The patient's paralysis resolved upon repletion of his low potassium and he was discharged with no neurologic deficits. Although rare, Periodic Paralysis must differentiated from other causes of weakness and paralysis so that the proper treatment can be initiated quickly.

Case presentation:

A 29 year-old male Mr. Akbar Ali from Ati Bazar, with no significant past medical history presented to the emergency department of ZHSWMC&H with sudden onset paralysis in the mid night. The patient had gone to bed at 10 pm with no weakness and awoke at midnight unable to move his upper or lower extremities. The weakness was bilateral and involved both the proximal muscles of the shoulders and hips as well as the distal extremities. He had no respiratory or swallowing difficulty and was able to move his neck and facial muscles. He denied any pain or paresthesia. Prior to this episode, the patient had been healthy and denied any recent diarrhea, chest pain, shortness of breath, or weight change. He did report several episodes of waking from sleep with a "racing heart." He did not take any medications and denied use of alcohol or drugs, or significant changes in diet or activity levels. His mother had been diagnosed with hyperthyroidism but his parents and brother had no history of similar episodes and no other significant illnesses.

On physical exam, the patient's heart rate was 124 and blood pressure was 125/81. He was average built, but otherwise normal in overall appearance. His skin was cool and dry, and the oral mucosa was moist. No jugular venous distension, goiter or lymphadenopathy were appreciated. Cardiac exam revealed tachycardia with a regular rhythm and no murmurs. Examination of the lungs and abdomen were unremarkable. There were no deformities or edema of the extremities and distal pulses were present and equal bilaterally. Neurologic exam revealed flaccid paralysis of all extremities which involved the proximal and distal muscles and included the hips and shoulders. Sensation was intact but deep tendon reflexes were slightly diminished to 3 out of 4 throughout. Cranial nerve function was grossly intact. Plantar reflexes were equivocal bilaterally.

Blood routine biochemistry, liver enzymes and complete blood count were normal except for a potassium level of 1.6 (3.5–5 mmol/L). Electrocardiogram revealed sinus tachycardia with 'U' wave in chest leads.After treatment, the ECG revealed a return to a sinus rhythm.

Two hours after initiation of intravenous potassium replacement, the patient's neurologic symptoms had completely resolved. His blood pressure remained elevated at 125/80, however repeat electrocardiogram revealed a normal sinus rhythm and rate. Follow up studies were performed to determine the etiology of the patient's hypokalemia. Urine sodium and potassium, and serum aldosterone and renin levels were measured to rule out adrenal involvement and were found to be normal. Thyroid stimulating hormone (TSH), triiodothyronine (T3) and thyroxine (T4) levels were obtained and

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revealed a normal reading, thyroid scan subsequently demonstrated a normal uniform thyroid with no other abnormality detected.

The patient was diagnosed with Hypokalemic Periodic Paralysis with no absolute cause. He was discharged home with advice to follow up in Medicine OPD.

Discussion:

Weakness is a common, non-specific, presentation in both the emergency and outpatient setting. Although the differential diagnosis for the complaint of weakness is extensive, the focus is considerably narrowed when a patient presents with a demonstrable decrease in muscle strength on physical exam. Strokes and tumors causing nerve compression are potentially life-threatening and must be ruled out first. Other relatively common neurologic concerns include post-ictal paralysis or one of the various motor neuron diseases. Diagnosis of these disorders requires obtaining a complete history with special consideration of timing, duration, and distribution of symptoms. Periodic Paralysis is often overlooked in the initial work-up.

Causes of acute weakness:

Neurologic: Stroke, Post-seizure paralysis, Myasthenia gravis, Cataplexy, Multiple sclerosis, **Inflammatory**: Polymyositis, Dermatomyositis; **Infectious**: Polio, Diphtheria, Botulism; Metabolic, Porphyria, Alcohol/ Opiates, Electrolyte disorders.

There are several types of Periodic Paralysis associated with metabolic and electrolyte abnormalities. Of these, Hypokalemic Periodic Paralysis (HPP) is the most common with a prevalence of 1 in 100,000.[1] The clinical features of the syndrome vary somewhat depending on the underlying etiology but the most striking feature is the sudden onset of weakness ranging in severity from mild, transient weakness to severe disability resulting in life-threatening respiratory failure. Attacks may be provoked by stress such as a viral illness or fatigue, or certain medications such as beta-agonists, insulin or steroids. A perturbation of sodium and calcium ion channels results in low potassium levels and muscle dysfunction.[2] As this is primarily a problem with muscle contraction rather than nerve conduction, tendon reflexes may be decreased or absent but sensation is generally intact. Although the serum potassium level is often alarmingly low, other electrolytes are usually normal. Indeed, total body potassium is actually normal with the change in the serum level reflecting a shift of potassium into cells.[3] Electrocardiographic changes are common, but unlike patients who are truly potassium depleted the changes do not correlate well with the measured serum level.[4] Diagnosis between paralytic episodes is difficult as the patient may have normal strength and potassium levels. Electromyography reveals abnormalities in some patients but is often normal, especially between episodes when no clinically detectable weakness is present.

Causes of Hypokalemia:

Potassium Depletion – **Renal**, Increased aldosterone, diuretics, hypomagnesemia, renal Tubular Acidosis (Type I and II), Metabolic alkalosis, Liddle's syndrome, **Potassium Depletion** – **Extra-renal**, Decreased intake, vomiting/Diarrhea, zollinger-ellison syndrome, fistulas, potassium Shift into Cells, Increased insulin, Alkalosis, Thyrotoxic Periodic Paralysis, Familial Hypokalemic Paralysis.

HPP occurs in several settings and the diagnosis may require an extensive search for the underlying etiology since the treatment varies according to the cause. HPP may occur sporadically in the form of Familial Hypokalmic Paralysis (FHP), a poorly understood disorder which may occur spontaneously or as the result of autosomal dominant inheritance [1]. This form of Periodic Paralysis is felt to be the result of disordered cellular potassium regulation perhaps due to sodium or calcium channel abnormalities.[5] Mutations of the CACNA1S and SCN4A genes have been identified that cause abnormalities in sodium channels resulting in abnormal potassium ion flux.[6] Acute paralytic episodes are treated with potassium replacement and close monitoring of the cardiac rhythm and serum potassium levels. Spironolactone and acetazolamide have been used for prophylaxis with some success although long-term potassium supplementation may be necessary.[2]

Paralytic episodes often occur at night, as was the case with this patient.[9] Any cause of hyperthyroidism can be associated with TPP but Grave's disease is the most common.[7] The major feature distinguishing TPP from other Periodic Paralyses is the association of paralytic episodes with the hyperthyroid state. Paralytic episodes can be induced in these patients by administering insulin and glucose, but only when they are hyperthyroid.[3] Euthyroid patients are typically free from spontaneous and induced attacks. The underlying mechanism is not known but is thought to be different from that of FHP since, in that disorder, thyroid hormone levels are normal and the administration of exogenous thyroid hormone does not result in paralytic episodes. Furthermore, the genetic abnormalities felt to be responsible for FHP have not been identified in patients with TPP.[5] Although acute paralytic episodes are treated with potassium replacement, prophylactic potassium or acetazolamide administration is not felt to benefit these patients since

potassium levels are normal between episodes and may result in dangerous hyperkalemia.[10] Beta-blocking agents may prevent attacks but the definitive treatment is correction of the underlying thyrotoxicosis.[3]

Endocrine abnormalities such as hyperinsulinemia and primary hyperaldosteronism have been associated with HPP.[11] Surgical removal of the aldosterone producing tumor is the preferred treatment although symptoms can often be managed with spironolactone.[8]

Hyperkalemic Periodic Paralysis and Paramyotonia Congenita are rare forms of Periodic Paralysis that are also associated SCN4A mutations that cause gain-of-function abnormalities in the sodium channel resulting in prolonged muscle cell excitation.[12]

Conclusion:

This patient presented with sudden onset paralysis and markedly abnormal potassium. The paralysis resolved completely following potassium replacement. At the time of discharge, he had no neurologic findings and a normal blood pressure of 125/80 and pulse of 74. He has not suffered any further episodes of paralysis and his potassium is now in the normal range.

Periodic Paralysis is important to consider when seeing a patient with sudden onset weakness or paralysis, especially those with no history or evidence of other diseases and no significant risk factors for stroke. Failure to properly diagnose and treat Periodic Paralysis can be fatal, but rapid correction of potassium abnormalities can resolve the symptoms quickly and completely. When possible, the underlying cause must be adequately addressed to prevent the persistence or recurrence of paralysis.

Abbreviations

TSH: Thyroid Stimulating Hormone; T3: Triiodothyronine; T4: Thyroxine; HPP: Hypokalemic Periodic Paralysis; FHP: Familial Hyperkalemic Paralysis; TPP: Thyrotoxic Periodic Paralysis

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