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CASE REPORT

Concurrent Hypokalemic Periodic Paralysis and Bipolar Disorder

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Primary periodic paralysis is a rare autosomal dominant disorder of ion-channel dysfunction, manifested by episodic flaccid paresis secondary to abnormal sarcolemma excitability. Membrane destabilization involving Na, K-ATPase has been hypothesized to be a biological etiology of the bipolar disorder (BD) and the mechanisms underlying lithium therapy have been linked to it. To date, there has been only one reported case of BD comorbid with periodic paralysis. Herein, we reported another case of concurrent bipolar mania and hypokalemic periodic paralysis (HPP), one special form of periodic paralysis. Consistent with the previous case, our patient responded well to lithium treatment for both bipolar mania and HPP. This might provide some support to the hypothesis that the therapeutic effects of lithium in both BD and HPP could be due to the correction of the underlying common pathophysiology.

Key words: Acute mania, bipolar disorder, hypokalemic periodic paralysis, lithium therapy

INTRODUCTION

The first reported a case of concurrent bipolar disorder (BD), and primary periodic paralysis was published by Raveendranathan *et al*.[1] Their case is a 26-year-old patient with a 2-year history of bipolar illness. During the course of hospitalization, the patient was found to have two episodes of abrupt-onset, generalized hypotonia, Grade 2 power in all limbs with absent reflexes, bilateral flexor-plantar response, and bipolar psychiatric mania. The two episodes of periodic paralysis lasted for <1 h, and the second episode improved after potassium supplementation. Herein, we report another case of concurrent bipolar mania and hypokalemic periodic paralysis (HPP). Consistent with the previous case, our patient responded well to lithium treatment for both bipolar mania and HPP.

CASE REPORT

A 29-year-old man who had been diagnosed with BD in 2009, experienced multiple manic episodes, and had been hospitalized into an acute psychiatric ward 8 times due to poor medical compliance and minimal insight. He reported no past, personal, or family history of medical illness, and denied abusing any psychoactive drug or alcohol. On April 20 of 2014, he was admitted to our acute psychiatric ward due to chronic BD with acute exacerbation. A mental status examination on admission revealed elevated mood, increased psychomotor activity, inflated self-esteem, distracted concentration, grandiose delusions, and auditory hallucinations. Initially, the patient received valproate 1000 mg/day, clotiapine 80 mg/day, and clonazepam 2 mg/day to treat his bipolar psychotic mania.

On May 1, the patient was found to have symptoms of abrupt-onset, generalized weakness in each limb in additional to acute mania. Interestingly, nursing records revealed that the patient exercised extensively and drank 2000 cc of root beer 1-day before his onset of limb weakness. The patient stated that he had two previous episodes of abrupt-onset limb weakness with spontaneous remission in the past 2 years. His inpatient neurological examinations showed Grade 1-2 power with absent reflexes in all limbs, bilateral flexor-plantar response, and normal sensorium. The results of his laboratory examinations, including an arterial blood gas; thyroid profile; plasma levels of magnesium, calcium, and phosphate; renal and liver function tests were all within normal limits. The results of electrocardiography (ECG); electroencephalography (EEG); and computed tomography (CT) of the brain showed unremarkable. Of note, his level of plasma potassium reduced to 2.6 mmol/L (3.1-5.3 mmol/L) from admission day (4.4 mmol/L). Furthermore, before potassium supplementation, other laboratory results showed: Plasma osmolality, 286 mosm/kg (250-330 mosm/kg); urine osmolality, 419 mosm/kg (50-1200 mosm/kg); spot urine

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potassium concentration, 9 mmol/L (25-125 mmol/day); spot urine creatinine concentration, 6.46 mmol/L; urine potassium-creatinine concentration ratio, 1.39; and transtubular potassium concentration gradient (TTKG), 2.36 (calculated by [urine/serum potassium]/[urine/serum osmolality]). Based on the patient's history, clinical symptoms, laboratory data, and treatment responses to potassium supplementation, a diagnosis of sporadic HPP were made by the nephrology team.

His limb muscle paralysis lasted for approximately 2 days. Given the diagnosis of HPP, the patient's hypokalemia was corrected with potassium supplementation (30 meq/day) on the first day, and his mood stabilizer valproate 1000 mg/day was changed to lithium 600 mg/day on the second day. Other psychotropic medications were unchanged. The lithium was titrated up to 900 mg/day 3 days after the episode. His lithium blood level reached an adequate level (0.8 meq/L) at a dose of 900 mg/day on May 8. Under the potassium supplementation and lithium treatment, the patient's limb muscle weakness and bipolar mania gradually remitted. His low plasma potassium level of 2.6 mmol/L returned to 4.9 mmol/L on the day of discharge, May 21 of 2014.

Since the starting of lithium treatment, the abrupt-onset limb weakness episode did not recur during the patient's hospitalization, and he showed significant treatment responses in his bipolar psychotic mania during his 3-week stay. At a 1-year follow-up, including fair drug adherence, the patient did not have any recurrence of muscle weakness or bipolar illness.

DISCUSSION

HPP is an autosomal dominant channelopathy, exacerbated by strenuous exercise, a high carbohydrate diet, cold, excitement, and specific drugs such as beta agonists, corticosteroids, and insulin.[1,2] This condition can result from a short-term shift of potassium into cells[2-4] and may last from 1-h to several days. The weakness may be generalized or localized.[1,2,5]

In the reported case, a history of strenuous exercise and high carbohydrate consumption, as well as normal findings for arterial blood gas, thyroid profile, plasma magnesium, calcium and phosphate levels, renal and liver function, ECG, EEG, and CT of the brain were used to distinguish HPP from secondary hypokalemic paralysis.[2-6] As suggested by Lin *et al*.,[2] three urinary, renal response indices to hypokalemia were present. The low spot urine potassium concentration, TTKG <3.0 mmol/mmol, and a urine potassium-creatinine ratio <2.5 mmol/mmol further confirm the diagnosis of HPP. Regarding the differential diagnoses of HPP, the absence of a family history of paralysis and the lack of symptoms or signs of hyperthyroidism excluded the possibility of familial and thyrotoxic periodic paralysis.

We did not find any other secondary cause of HPP in the present case, but a good treatment response to the lithium and clotiapine combination, with no recurrence of muscle weakness, was observed. It has been hypothesized that there may be a common pathophysiology involving membrane destabilization in both BD and HPP.[1,7] Many BD pathophysiology studies have consistently shown altered homeostasis of biologically active alkali and alkaline earth metals along with alterations in neuronal excitability and activity.[1,8] Some studies have suggested that a primary or secondary dysfunction of Na, K-ATPase plays a predisposing or more direct etiological role in BD. Specifically, there may be a reduction in Na, K-ATPase activity that can lead to both mania and depression by increasing membrane excitability and decreasing neurotransmitter release, respectively.[1,8]

Consistent with the previous case,[1] our patient had a clinical response to the lithium with no recurrence of weakness and bipolar illness, although our case had taken potassium for treating his HPP. This might provide some support to the hypothesis that the therapeutic effects of lithium in both BD and HPP could be due to the correction of the underlying common pathophysiology.[1,9]

REFERENCES

1. Raveendranathan D, Babu GN, Desai G, Chandra PS. Bipolar disorder co-occurring with periodic paralysis: A case report. J Neuropsychiatry Clin Neurosci 2012;24:E11-2.
2. Lin SH, Lin YF, Chen DT, Chu P, Hsu CW, Halperin ML. Laboratory tests to determine the cause of hypokalemia and paralysis. Arch Intern Med 2004;164:1561-6.
3. Lin SH, Lin YF, Halperin ML. Hypokalaemia and paralysis. QJM 2001;94:133-9.
4. Lin SH, Davids MR, Halperin ML. Hypokalaemia and paralysis. QJM 2003;96:161-9.
5. Venance SL, Cannon SC, Fialho D, Fontaine B, Hanna MG, Ptacek LJ, *et al.* The primary periodic paralyses: Diagnosis, pathogenesis and treatment. Brain 2006;129(Pt 1):8-17.
6. Lin SH, Halperin ML. Hypokalemia: A practical approach to diagnosis and its genetic basis. Curr Med Chem 2007;14:1551-65.
7. Bernard G, Shevell MI. Channelopathies: A review. Pediatr Neurol 2008;38:73-85.
8. El-Mallakh RS, Wyatt RJ. The Na,K-atpase hypothesis for bipolar illness. Biol Psychiatry 1995;37:235-44.
9. Glen AI, Reading HW. Regulatory action of lithium in manic-depressive illness. Lancet 1973;2:1239-41.