Case Report

Thyrotoxicosis with periodic paralysis

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Abstract

This case report is intended to highlight the importance of suspecting thyrotoxicosis in cases of periodic flaccid paralysis to facilitate its early diagnosis. Thyrotoxic periodic paralysis is a complication of thyrotoxicosis, more common among males in Asia. It presents as acute flaccid paralysis with associated hypokalemia. The features of thyrotoxicosis may be subtle or absent. We report a case of 33-year-old male patient with periodic flaccid paralysis. Hypokalemia secondary to thyrotoxicosis was diagnosed as the cause of the paralysis. The patient was treated with intravenous and oral potassium therapy. The patient showed complete recovery after this management and was discharged after 24 h with no residual paralysis. Thus, in cases of recurrent or acute flaccid muscle paralysis, it is important to consider thyrotoxicosis as one of the possible causes and take measures accordingly.

Key words: Hypokalaemia, periodic paralysis, thyrotoxicosis

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INTRODUCTION

Periodic paralysis is an uncommon manifestation of thyrotoxicosis. It is known to occur more in Asian populations. The overall incidence of thyrotoxicosis periodic paralysis (TPP) in Chinese and Japanese thyrotoxic patients is 1.8% and 1.9%, respectively. However the number of TPP cases reported in Western countries has increased recently due to globalization and immigration.[1] The patient may not present classical symptoms of thyrotoxicosis, thus timely diagnosis may be hampered. We report such a case of recurrent flaccid paralysis which was caused by silent thyrotoxicosis.

CASE REPORT

A 33-year-old male presented at our institute with weakness of all four limbs, which started in morning. He had no history suggestive of sensory, cranial nerve, bladder, or bowel involvement. There was no history of trauma, fever, recent vaccination, heavy exercise, or high carbohydrate ingestion prior to this episode. He had two similar episodes in the past 1 year. First episode was mild which recovered within few hours. Second episode was preceded by sweet consumption and recovered in few hours after hospitalisation. No family member had similar symptoms. He had family history of diabetes. He was diagnosed for diabetes mellitus for the past 3 years and was on oral antihyperglycemic agents with good glycemic control.

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On examination, the patient had a small goitrous swelling in the neck [Figure 1a]. He had sinus tachycardia and fine tremors. He had flaccid weakness of all four limbs and was unable to stand. Power in upper limb was 4/5 proximally and 5/5 distally. Power in lower limb was 3/5 proximally and 4/5 distally. Deep tendon reflexes were diminished in both limbs and the plantar response was flexion bilaterally. Rest of the neurological and systemic examination was otherwise normal. Recurrent episodes of flaccid paralysis with quick recovery in the hospital were suggestive of a periodic paralysis. Laboratory investigations are shown in Table 1.

These findings were consistent with hypokalemic periodic paralysis. Further investigations were aimed at establishing the cause of hypokalemia. Based on the history collected from the patient, the causative factors such as familial periodic paralysis, gastrointestinal disorders causing potassium loss, and chronic diuretic

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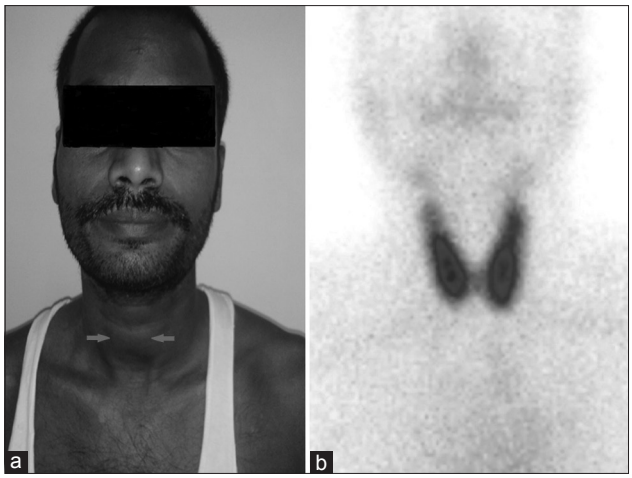

Figure 1: (a) Patient of thyrotoxicosis periodic paralysis showing mild goitre (as shown by arrows in the neck) (b) ^{99m}Tc thyroid scan showed diffuse increased uptake of iodine in both thyroid lobes

abuse were excluded. Thyroid function tests were suggestive of thyrotoxicosis.

^{99m}Tc thyroid scan showed diffuse increased uptake of iodine which was suggestive of Graves' disease [Figure 1b]. Thus, thyrotoxicosis was established as the cause of recurrent hypokalemic paralysis in this patient. He was started on potassium supplement (intravenous and oral) and treatment for thyrotoxicosis (tab carbimazole 10 mg three times a day and tab propranolol 40 mg twice a day) simultaneously. With this treatment, he recovered completely with serum potassium 4.5 mmol/L after 24 h.

DISCUSSION

Periodic paralysis is a rare complication of thyrotoxicosis affecting predominantly males. The male to female ratio ranges from 17:1 to 70:1 in different series.[1,2] The higher incidence of TPP in males could be probably due to higher androgen levels in males.[3] Patients with TPP are usually in the age group of 20-40 years, although occurrence of TPP in adolescents has also been reported.[4] TPP is characterized by recurrent, transient episodes of muscle weakness. Severity of episode varies from mild weakness to complete flaccid paralysis. Each episode of weakness may last from a few hours up to 72 h with complete recovery in between the attacks. It is a pure motor ascending paralysis involving predominantly proximal muscles of limbs. However in a severe attack, total paralysis of respiratory, bulbar, and ocular muscles can occur.[5] Attacks occur mostly in early morning hours due to higher plasma catecholamine and sympathetic tone.[6] Precipitating factors of hypokalemic TPP include strenuous exercise followed by rest, excessive ingestion of carbohydrate-rich food and drug administration, for example, corticosteroids.[6]

Table 1: Investigations done in this patient

Investigations	Observed value	Normal range
Serum potassium (pretreatment) (mmol/L)	2.3	3.5-5
Serum potassium (posttreatment) (mmol/L)	4.5	3.5-5
Fasting blood glucose (mmol/L)	6.06	4.96-7.16
Postprandial glucose (mmol/L)	10.90	7.71-9.91
HbA1C (%)	7.5	6-7
Serum sodium (mmol/L)	134	135-145
Serum magnesium (mmol/L)	1.01	0.79-1.32
Serum calcium (mmol/L)	2.25	2.25-2.75
Seum phosphate (mmol/L)	1.44	0.8-1.44
TSH (mIU/L)	0.02	0.35-5.5
Free T4 (pmol/L)	44.53	11.45-22.65
Free T3 (pmol/L)	0.12	0.03-0.06

HbA1c: Glycosylated hemoglobin, TSH: Thyroid-stimulating hormone

One of the differential diagnoses to this condition is familial hypokalemic periodic paralysis from which it is differentiated by thyroid function test. The majority of cases of hyperthyroidism associated with TPP are due to Graves' disease. TPP may be the presenting feature of Graves' disease or present during relapse or after radioactive iodine therapy.[1] TPP may occur with other causes of thyrotoxicosis like thyroiditis, toxic nodular goitre, toxic adenoma, thyroid stimulating hormone (TSH) secreting pituitary tumor, ingestion of Thyroxine (T4), and inadvertent iodine excess. Clinical symptoms of hyperthyroidism are seen in very few patients and many times no symptoms are noted.

Hypokalemia is central to pathogenesis of TPP which occurs due to a massive shift of potassium into the cells. This is believed to be related to increased sodium-potassium-adenosine triphosphatase (Na^+/K^+-ATPase) pump activity. Skeletal muscle being the single largest pool of total body K^+ store plays an important role in extracellular K^+ homeostasis. In the skeletal muscle, Na^+–K^+ ATPase provide the main access for inward K^+ movements, while K^+ channels including inward rectifying K^+ (K_{ir}) and delayed rectifying K^+ channels provide access for outward K^+ movements. In thyrotoxicosis, there is increased Na^+–K^+ ATPase activity. The α_1-, α_2-, β_1-, β_2-, and β_4-subunits of Na^+/K^+-ATPase are expressed in skeletal muscles. Thyroid hormone-responsive elements are present in the upstream region of these genes. Thyroid hormone increases Na^+/K^+-ATPase activity via both transcriptional and posttranscriptional mechanisms. Thus, thyrotoxicosis is associated with hypokalemia, which

causes paradoxical depolarization of cell membrane. This hypokalemia-induced paradoxical depolarization of the resting membrane potential leads to inactivation of Na^+ channels, rendering them unexcitable, leading to paralysis.[3] With control of thyrotoxicosis, Na^+/K^+-ATPase activity returns to a level seen in normal healthy people.[7] Apart from thyroid hormones; catecholamine, insulin and androgens can also increase Na^+/K^+-ATPase activity in skeletal muscle.[8,9] The association of TPP with carbohydrate-rich meals and sweet snacks may be explained by hyperinsulinemic response. Type 2 diabetes is associated with hyperinsulinemia, which may be additional risk factor for TPP in patients with thyrotoxicosis and diabetes as seen in our case.

During periodic paralysis and marked hypokalemia, treatment consists of immediate supplementation with potassium chloride (KCl) at slower rate to avoid rebound hyperkalemia. With the treatment paralysis can improve in 24 h. Oral or intravenous propranolol, a nonspecific β-adrenergic blocker, can be used as an alternative treatment to ameliorate the paralysis without rebound hyperkalemia.[10] Adequate control of hyperthyroidism is the mainstay of therapy. Patients should avoid precipitating factors until thyrotoxicosis is under control. The use of nonselective β-blockers is important till a euthyroid status is not achieved. Regular potassium supplementation as prophylaxis against further paralysis is ineffective.

In our patient, the diagnosis of thyrotoxicosis was delayed due to lack of any florid features of thyrotoxicosis. Thus, this case highlights the importance of suspecting thyrotoxicosis in cases of recurrent periodic flaccid paralysis; especially in Asian men to facilitate early diagnosis and thyroid function test should form a routine part of assessment of it.

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