

Thyrotoxic Periodic Paralysis in a 20-Year-Old Nigerian Male

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Abstract

Background: Thyrotoxic Periodic Paralysis (TPP) is a rare complication of hyperthyroidism characterised by hypokalaemia and recurrent episodes of muscle weakness. Increased awareness will promote early diagnosis and prompt treatment of the condition.

Objective: To highlight an uncommon case of TPP in a Nigerian male with normokalaemia on presentation.

Case: A 20-year-old male patient on treatment for hyperthyroidism (Grave's disease) who was referred to the endocrine clinic on account of recurrent episodes of acute symmetrical painful lower limb muscle weakness. He had experienced a total of 5 episodes approximately 2-3 months apart with each attack lasting between 10-36h there was a positive history of strenuous activities preceding each attack. Limb pain was relieved by analgesics and weakness resolved spontaneously without any specific medications after 2-3 days.

Investigations revealed elevated T3 and T4 (212.3 ng/ml and 18.3 µg/ml respectively), reduced TSH (<0.1 mIU/ml), low-normal serum potassium (3.6 mmol/L) on presentation and hypokalaemia (2.5 mmol/L) during an episode and hypocalcaemia (2.0 mmol/L). He was placed on 30 mg of carbimazole, propranolol 120mg in divided doses and low dose oral potassium chloride. He showed remarkable response to treatment with reduction in the frequency of attacks and eventual resolution of symptoms.

Keywords: Hyperthyroidism; Paralysis; Hypokalaemia

Introduction

Thyrotoxic periodic paralysis (TPP) is the most common acquired form of periodic paralysis. It is an uncommon disorder characterized by simultaneous thyrotoxicosis, hypokalaemia, and recurrent episodes of limb paralysis without alteration in consciousness [1-4]. TPP affects mainly men of Asian descent. It begins at 20-40 years of age [3,4]. It has also been reported in Caucasians, Native American Indians, Blacks and Aborigines [5-8].

Case Report

A 20-year-old male patient on treatment for hyperthyroidism (Grave's disease) diagnosed about ten (10) months prior to presentation. He was referred to the endocrine clinic following recurrent episodes of acute bilaterally symmetrical painful lower limb muscle weakness. He had experiences a total of five (5) episodes approximately 2-3 months apart (three episodes before presentation). Each attack lasted about 10 h to 36 h with associated inability to stand or walk unaided. There was no associated loss of consciousness or seizures attacks. He had no fever or upper respiratory tract infection. There was a positive history of strenuous activities preceding each attack (usually during rest after returning from the gymnasium). Limb pain was relieved by analgesics and weakness resolved spontaneously without any specific medications after 2-3 days. He never presented to the hospital during periods of attacks.

There was no family history of limb paralysis; however, he had a positive family history of Grave's disease. He is a non-smoker and non-alcoholic.

He was on oral carbimazole 20 mg daily and propranolol 80 mg daily in divided doses.

On presentation, he still experienced classic features of hyperthyroidism such as: palpitation, distal tremors, heat intolerance, weight loss and anxiety.

On general examination, he looked anxious with sweaty palms and fine hands tremor; resting tachycardia of 110/min, diffused thyromegaly (right lobe larger than the left), impaired ocular convergence (loss of accommodation reflex), onycholysis present, blood pressure of 120/60 mmHg. Other systemic examinations were unremarkable (Tables 1 and 2).

Laboratory test results were as shown below:

	1	2	3	4	Reference
T3	212	217	159	71	60-185 ng/ml
T4	18.3	17	9	7.7	4-12 µg/ml
TSH	<0.1	0.2	0.4	0.5	0.4-6.0 mIU/ml

Table 1: Thyroid function test results.

Full blood count: Haemoglobin = 13.2 g/dl; Packed cell volume = 44%; white blood cell count = $3.4 \times 10^9/L$ ($3 - 10^9/L$); Erythrocyte sedimentation rate (ESR) 3mm/1st hr.

Fine needle aspiration cytology, FNAC: Benign follicular lesion

Thyroid ultrasound scan: Diffusely enlarged goiter involving both lobes with increased vascularity

ECG: tachycardia with non-specific ST and T waves changes

	Before Treatment		After Treatment	Reference
	Days after attack	During attack		
K+	3.6	2.5	3.8	3.5 - 5 mmol/l
Calcium	2.2		2.6	2.1 - 2.6 mmol/l
Na+	142		142	135 - 150 mmol/l
Cl-	10.3		10.2	96 - 108 mmol/l
Hco3-	27		21	21 - 30 mmol/l
Urea	13		11	15 - 40 mg/dl
Creatinine	0.7		0.8	0.5 - 1.5 mg/dl
Phosphate	3.6			2.0 - 4.5 mmol/l

Table 2: Serum electrolytes.

Based on clinical and laboratory findings, a diagnosis of hypokalemic Thyrotoxic Paralysis, TPP associated with Graves' disease was made. Doses of carbimazole was increased from 10 mg b.d to 10 mg t.d.s and propranolol increased to 40 mg t.d.s; Low dose oral potassium chloride tablets were administered. Patient was counseled on his condition and advised on low carbohydrate diet, to avoid alcohol and strenuous exercise. He showed remarkable response to treatment both clinically and biochemically as he had marked reduction in the frequency and severity of attacks initially and later no other episodes of limb weakness on long follow-up and levels of electrolytes and thyroid hormones normalized.

Discussion

TPP is more often overlooked and/or delayed due to lack of awareness among the physicians and associated mild symptoms of hyperthyroidism [9,10]. The index case, a 20-year-old Nigerian male on treatment for Grave's hyperthyroidism presented with recurrent history of sudden bilateral lower limb paralysis which was associated with an initial low-normal level of serum potassium, with blood samples taken some days after the attack. However, serum potassium level taken during period of attack revealed a subnormal value. Each episode occurred following a strenuous activity (exercise).

TPP is an infrequent feature of hyperthyroidism [11-13]. It has a male predominance (male to female ratio of 20:1) with a racial and age predisposition being relatively more common in people of Asian descent in their 20s to 40s [11-15].

Therefore, a diagnosis of TPP must be considered in the setting of periodic paralytic attacks and hyperthyroidism with decreased or even normal potassium levels. TPP with normal potassium levels can mimic

other neurologic disorders such as myasthenia gravis, Guillain-Barré syndrome or psychogenic paralysis [16].

The pathophysiologic mechanism of TPP is not well understood. Evidence suggests that TPP results from a combination of factors such as genetic, environmental, and thyrotoxicosis [17] the interaction of these factors would alter the channel dynamics of the cell membrane at the neuromuscular junction, triggering the paralysis crises only in patients genetically susceptible [18]. The genetic factors could include a defect in one of the ion channels involved in excitation contraction coupling (Ca^{2+} , Na^+ , and K^+) or a defect in one of the channel's regulatory subunits. Alterations in one of these genes would be responsible for the generation of non-functional ion channels, which would define the TPP as an endocrine channelopathy [19,20]. The environmental factors include the excessive consumption of carbohydrate-rich foods, alcohol, or resting after intense exercise. In addition, several other studies have demonstrated that the activity of the Na^+/K^+ -ATPase pump is increased in thyrotoxicosis and is more exacerbated in patients with TPP [21,22]. The hypokalemia observed in these cases is due to the increased K^+ influx into a cell secondary to the increase in the activity of the Na^+/K^+ -ATPase pump and by the hyperinsulinemic response to carbohydrate intake in patients susceptible to TPP [23,24]. Androgens also can increase the activity of the Na^+/K^+ -ATPase pump, which explains the higher incidence of the disease in young males [24].

In patients with TPP, hypokalemia appears to be the primary laboratory alteration at the time of crisis. However, there are some reports of normokalemia, but these reports may be due to errors during blood sample collection, i.e., sample collection in a late stage of the crisis after the serum concentrations of potassium have already recovered, or due to improper storage of the samples, predisposing them to hemolysis [16,18,25].

The hyperthyroidism in the index patient was treated with carbimazole and propranolol to achieve euthyroidism, while potassium and calcium supplements were administered to correct hypokalaemia and hypocalcaemia respectively; patient advised to avoid precipitants such as strenuous exercise, alcohol and heavy carbohydrate consumption among others. There was reduction in the frequency and severity of attacks and subsequently no further attacks.

Treatment of TPP includes potassium replacement therapy via intravenous or oral route based on the severity of hypokalemia. Non selective β -blockers such as propranolol are useful for both treatment and prevention of recurrence of attacks. The main treatment of TPP involves control of hyperthyroidism using anti-thyroid medications, radioiodine ablation or surgical therapy [16,25].

Conclusion

Thyrotoxic periodic paralysis should be suspected in a thyrotoxic patient who presents with limb weakness. The finding of normokalemia in such patient does not exclude the diagnosis of TPP. Thus serial monitoring of potassium levels is recommended particularly during attacks as hypokalemia is most prominent during attacks. Precipitants must be sought for and prevented.

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