CASE REPORT

Muscle paralysis in thyrotoxicosis

Fraz Anwar Siddiqui,¹ Aisha Sheikh²

¹Aga Khan University Hospital, Karachi, Sindh, Pakistan
²Department of Medicine, Aga Khan University Hospital, Karachi, Sindh, Pakistan

Correspondence to
 Dr Fraz Anwar Siddiqui,
 fraz_22@hotmail.com

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SUMMARY

Thyrotoxic periodic paralysis (TPP) is a condition characterised by muscle paralysis due to hypokalaemia usually secondary to thyrotoxicosis. We report a case of a 31-year-old man with no known comorbidities who presented to a tertiary healthcare unit with a 1-month history of difficulty in breathing, palpitations, weight loss and hoarseness of voice. On examination, his thyroid gland was palpable and fine hand tremors were present. An initial provisional diagnosis of hyperthyroidism was made. Three months after initial presentation, the patient presented in emergency with severe muscle pain and inability to stand. Laboratory results revealed hypokalaemia. All the symptoms reverted over the next few hours on administration of intravenous potassium. A diagnosis of TPP was established. After initial presentation, the patient was treated with carbimazole and propranolol. Once he was euthyroid, radioactive iodine ablation therapy (15 mCi) was carried out as definitive therapy, after which the patient's symptoms resolved; he is currently doing fine on levothyroxine replacement and there has been no recurrence of muscle paralysis.

BACKGROUND

Thyrotoxic periodic paralysis (TPP) is a condition characterised by muscle paralysis due to hypokalaemia, usually secondary to thyrotoxicosis.¹ Patients may present in the emergency department with muscle weakness as a rare presentation of hyperthyroidism.² Proximal are more affected than distal muscles.³ Potassium supplementation and non-selective β -blockade can help revert muscle symptoms and prevent cardiac arrhythmias.⁴ This case illustrates how easily TPP can be misdiagnosed because of its rare prevalence if proper clinical correlation is not made.⁴ Our patient also had vitamin-D₃ deficiency, highlighting the association between TPP and other endocrinopathies.¹

CASE PRESENTATION

A 31-year-old man with no known comorbidities presented to a tertiary care teaching hospital with a 1-month history of difficulty in breathing, palpitations and hoarseness of voice. He also reported of 10 kg weight loss in the past 1 month. There was no family history of thyroid disorder. On examination, his pulse was 76/min and blood pressure was 120/80 mm Hg, he had a grade 1 diffuse goitre and there were fine tremors on his hands when outstretched; his eyes were normal. An initial provisional diagnosis of hyperthyroidism was made. A daily dose of 30 mg carbimazole was started along with propranolol 10 mg three times daily.

Three months after initial presentation, the patient presented in the emergency department with stiffness in his legs and inability to stand. He was given intravenous potassium replacement (40 mEq) keeping in view the diagnosis of hypokalaemic periodic paralysis. His symptoms reverted after potassium supplementation. He was discharged on oral potassium supplementation and advised to be followed up in Endocrine Clinic. Diagnosis of Grave's disease with TPP was made.

INVESTIGATIONS

Laboratory tests showed serum potassium 1.8 mmol/L (3.5–5.1) and vitamin-D₃ 9.13 pg/mL (vitamin D deficiency: <20). Thyroid function test revealed thyroid-stimulating hormone (TSH) <0.005 mIU/L (0.4–4.2), free thyroxine (FT4) 33.9 pmol/L (11–22), antithyroglobulin antibodies 21.00 IU/mL (<40) and antithyroid peroxidase antibodies 512 IU/mL (<35). The patient's repeat potassium after 4 h of replacement was 5.0 mmol/L.

DIFFERENTIAL DIAGNOSIS

TPP can be distinguished from other forms of periodic paralysis. In our case, the absence of a family history of muscle paralysis, predominance of male sex and deranged thyroid function tests strongly favoured a diagnosis of TPP over hypokalaemic periodic paralysis. Other causes of excess loss of potassium, such as diarrhoea, vomiting and a history of drug use, should also be evaluated; these were not present in our patient.¹

TREATMENT

The patient's propranolol dose was increased to 40 mg, three times daily. Carbimazole was continued as before. Radioactive iodine (RAI or I¹³¹) was advised. The patient was asked to stop carbimazole 5 days prior to RAI or I¹³¹ treatment. RAI or I¹³¹ ablation therapy (15 mCi) was carried out 6 weeks after presentation to the emergency department.

OUTCOME AND FOLLOW-UP

The patient attended the clinic 6 weeks after RAI ablation therapy. His general condition was much better and limb pain had improved, there were no further episodes of TPP and there was a 3 kg weight gain; however, he reported of cold intolerance. Recent laboratory tests revealed free thyroxine (FT4) 7.4 pmol/L (11–22) and serum potassium 4.1 mmol/L. A diagnosis of post-RAI ablation hypothyroidism was made. He was started on levothyroxine, which was later adjusted to keep serum TSH within normal range. On his regular follow-up visits in outpatient clinic, he is doing fine on levothyroxine replacement and there is no recurrence of muscle paralysis.

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DISCUSSION

TPP usually affects males of Asian origin. Reports show that incidence of TPP in thyrotoxic patients in China and Japan are 1.8% and 1.9%, respectively.¹ Incidence of TPP in hyperthyroid Caucasians in North America is 0.1–0.2%.¹ A lot of sporadic cases are being reported these days in non-Asian population.¹ To best of our knowledge, a case of TPP in Pakistan has not been reported before.

Haemostasis of potassium in the body is maintained by a Na/K-ATPase pump and β -Adrenergic receptors.² Dysfunction of the Na/K-ATPase pump causes hypokalaemia and is responsible for the muscle symptoms.² Rest promotes shifting of potassium into the muscles. This is the reason symptoms of TPP improve with exercise.^{3–4} Dysregulation of the Na/K-ATPase pump can also increase the sensitivity of the β -receptors.⁴ This effect can be masked by use of non-selective β -blockers, as we achieved in our patient by increasing the dose of propranolol.⁴ Hyperinsulinaemia can also trigger attacks of TPP compared with thyrotoxic patients, who do not have TPP.⁵ This also explains why carbohydrate rich foods can precipitate attacks of TPP. Although these precipitating factors were absent in our patient.

Ample research has been carried out to determine the linkage of TPP with genetic mutations. Human leucocyte antigen (HLA) haplotypes DRw8 and A2BW22 are found to be associated with the Japanese and Chinese populations, respectively.¹ Mutations in single-nucleotide polymorphisms of the L-type calcium channel have also been found to be associated with TPP.⁶ Genetic linkage of TPP in the Pakistani population has not yet been studied.

Our patient was 31 years of age. TPP is common in males 20–40 years of age.¹ An attack usually first affects the lower limbs and then ascends. However, the condition resolves in a reverse manner.⁴ An attack can last up to 72 h.⁴ Most commonly, an attack is triggered by a carbohydrate rich meal or while resting after exercise.⁴ The hypokalaemia is usually severe enough to cause ECG changes.⁴ Although our patient had significant hypokalaemia, there were no specific ECG changes.

Patients usually present with elevated FT4 and suppressed TSH levels. TSH receptor antibodies (TRAbs) are hallmarks of Graves' disease (GD). TRAbs are present in 95–96% patients with GD. Antithyroid peroxidase (anti-TPO) antibodies, although specific for Hashimoto's thyroiditis, can be present in 80% of patients with Graves' disease.⁷ TRAbs testing is technically difficult and not available in Pakistan. We used anti-TPO antibody titres and clinical judgement to establish diagnosis in our case.

Initial treatment involves restoration of total body potassium to relieve muscle paralysis. Overambitious potassium replacement can result in fatal dysrhythmia. Therapy with <50 mEq of potassium chloride is considered safe.⁴ Our patient stabilised after potassium replacement. Oral or intravenous propranolol can be used as an alternative therapy during emergency management of TPP. Spironolactone and acetazolamide have not proved to be very effective as compared to propranolol.¹

Definitive therapy is usually antithyroid medications initially, followed by thyroidectomy or radioiodine ablation therapy to avoid risk of paralytic attacks in future.⁴ Antithyroid medications such as thionamides can be started to make the patient euthyroid. Long-term therapy with thionamides can resolve symptoms in over 50% of thyrotoxic patients.⁸ We treated our

patient with adjusted doses of carbimazole to render him euthyroid before we could attempt RAI therapy.

Radioactive iodine therapy can be discussed with the patient as a definitive management of thyrotoxicosis; however, chances of recurrence of symptoms are possible even if the patient has acquired a normal state.¹ Usually, patients acquire a euthyroid state 2 months after ablation therapy.⁸ Radioactive ablation should be avoided in patients with a history of cardiac disease.⁴ In some cases, worsening of thyrotoxic symptoms have also been reported.⁸ The most commonly encountered side effect is development of hypothyroidism.⁸ Our patient also presented with hypothyroidism after ablation therapy, which was managed with levothyroxine replacement.

Total thyroidectomy is also an option of choice. Side effects such as haemorrhage, hypocalcaemia and recurrent laryngeal nerve paralysis can occur after surgery. As in postablation therapy, the patient may require levothyroxine replacement.⁸ Our patient preferred radioiodine ablation therapy to avoid surgical risk, and he did not report any paralytic attack once clinically euthyroid after ablation therapy.

Learning points

- ▶ Muscle paralysis is a rare presentation of thyrotoxicosis, and can cause a lot of damage if competent a clinical link is not established.
- ▶ Thyrotoxic periodic paralysis (TPP) usually affects young males of Asian origin. Most often an attack is triggered by a carbohydrate-rich meal or while resting after exercise.
- ▶ Symptoms of TPP can be resolved on potassium supplementation.
- ▶ Once the patient is euthyroid, definitive treatment such as radioactive iodine ablation therapy can be discussed.

Contributors FAS wrote the main text of the case report and is the corresponding author. AS managed the patient, assisted in manuscript writing and reviewed the case report.

Competing interests None declared.

Patient consent Obtained.

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REFERENCES

- 1 Kung AW. Clinical review: thyrotoxic periodic paralysis: a diagnostic challenge. *J Clin Endocrinol Metab* 2006;91:2490–5.
- 2 Lin SH, Huang CL. Mechanism of thyrotoxic periodic paralysis. *J Am Soc Nephrol* 2012;23:985–8.
- 3 Pothiwala P, Levine SN. Analytic review: thyrotoxic periodic paralysis: a review. *J Intensive Care Med* 2010;25:71–7.
- 4 Lam L, Nair RJ, Tingle L. Thyrotoxic periodic paralysis. *Proc (Bayl Univ Med Cent)* 2006;19:126–9.
- 5 Vijayakumar A, Ashwath G, Thimmappa D. Thyrotoxic periodic paralysis: clinical challenges. *J Thyroid Res* 2014;2014:649502.
- 6 Kung AW, Lau KS, Fong GC, et al. Association of novel single nucleotide polymorphisms in the calcium channel $\alpha 1$ subunit gene (Ca(v)1.1) and thyrotoxic periodic paralysis. *J Clin Endocrinol Metab* 2004;89:1340–5.
- 7 Kamath C, Adlan MA, Premawardhana LD. The role of thyrotrophin receptor antibody assays in Graves' disease. *J Thyroid Res* 2012;2012:525936.
- 8 Saleem T, Sheikh A, Masood Q. Resistant thyrotoxicosis in a patient with graves disease: a case report. *J Thyroid Res* 2011;649084.

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