Thyrotoxic Periodic Paralysis in Long Standing Graves’ Disease: An Unusual Presentation with Normokalemia

Lakshmi Kannan, Young Nam Kim

Departments of Internal Medicine, and Internal Medicine and Endocrinology, Einstein Medical Center, Philadelphia, Pennsylvania, USA

Abstract

Context: Thyrotoxic periodic paralysis (TPP) is a potentially life-threatening complication of hyperthyroidism that is underdiagnosed and frequently missed. It is relatively common in Asian men with Graves’ disease. TPP attacks are frequently associated with hypokalemia.

Case Report: Here we report a non-Asian female patient with Graves’ disease, who presented with flaccid paralysis associated with an episode of subacute thyroiditis (SAT). Interestingly, she was found to have low normal potassium levels in the serum during the initial attack despite which she continues to require low dose potassium supplementation to prevent recurrent TPP attacks. Unique features in our patient include her gender, ethnicity, time lag between initial diagnosis of Graves’ disease, and the development of TPP and borderline low potassium levels, with the continuous need for prophylactic potassium supplementation. Conclusion: It is important to be aware of this complication of hyperthyroidism that has a dramatic yet variable presentation, but is readily amenable to therapy.

Keywords: Graves', Paralysis, Potassium, Thyroiditis, Thyrotoxic

Address for correspondence: Dr. Lakshmi Kannan, Department of Internal Medicine, Einstein Medical Center, 5501 Old York Road, Philadelphia, Pennsylvania - 19141, USA. E-mail: Kannanla@Einstein.edu

Introduction

Thyrotoxic periodic paralysis (TPP) is a life-threatening medical emergency. Though an uncommon complication of the thyrotoxic state, this condition is readily amenable to treatment if promptly diagnosed. The classic description is that of an Asian male patient with Graves’ disease presenting with acute onset flaccid, ascending paralysis of the lower extremities associated with hypokalemia, usually precipitated by stress or carbohydrate-rich meals. This classic presentation has been questioned recently as we begin to learn more about atypical presentations. It is important to be aware of the various manifestations and clinical contexts of this potentially fatal complication of thyrotoxicosis. Here we report such a unique presentation of TPP that was identified and treated promptly.

Case Presentation

A 34-year-old African American female presented with excessive sweating, tremors, sore throat, and neck pain that was followed by aches and weakness in her lower limbs. Patient’s past medical history was significant for Graves’ disease diagnosed about a decade ago, when she had declined surgical options and radioiodine ablation, but continued medical therapy for maintenance of a euthyroid state. She denied any precipitating events for her weakness, such as physical exertion, heavy carbohydrate meals, or alcohol intake preceding the weakness. Physical examination revealed a tender goiter. Motor strength in the lower extremities was 3/5. Serum potassium was 3.6 mmol/L (lab reference range 3.5-5) and thyroid function tests showed hyperthyroidism. She was diagnosed with TPP precipitated by subacute thyroiditis (SAT). The patient was given propanolol, methimazole, potassium chloride, and nonsteroidal...
anti-inflammatory analgesics. The patient’s weakness improved and pain diminished. She had a similar episode of weakness few days later with similar borderline serum potassium levels. She was started on low-dose oral potassium supplementation to maintain high normal serum potassium levels and continues to need this till date to prevent recurrent attacks.

**Discussion**

Here we report a patient with Graves’ disease who developed SAT and hyperthyroidism precipitating TPP. Interestingly serum potassium was on the lower limit of normal, but the patient responded to potassium supplementation. This is a rare case of TPP precipitated by SAT in an African American female, with a borderline low potassium level requiring prophylactic oral potassium supplementation.

TPP is an infrequent feature of hyperthyroidism.\(^1\) 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.\(^2,7,8\) Though uncommon, it is a potentially life-threatening complication of hyperthyroidism.\(^3\) Classically it is described as a flaccid ascending paralysis associated with hyperthyroidism and hypokalemia due to intracellular redistribution of potassium. Thyrotoxicosis leads to hyperinsulinemia and also increased expression and direct activation of the Na\(^+\) K\(^+\) ATPase on cellular membranes leading to intracellular shift of potassium.\(^4\) Though common in Graves’ disease, it has also been reported in thyroiditis and toxic multinodular goiter (MNG). It is very rare after euthyroid state has been achieved.\(^5\) Common precipitating factors include heavy exercise and consumption of a carbohydrate rich meal. Patients usually present in the early morning hours with weakness usually in their lower extremities. Attacks are preceded by muscle cramps and aches for a few days. They can be recurrent and typically correlate with biochemical hyperthyroidism.

Management includes immediate beta blocker therapy which acts on the Na\(^+\) K\(^+\) ATPase directly. Careful correction of potassium with low dose potassium supplementation is required as rebound hyperkalemia is reported in about 40% of patients.\(^6\) Definitive management includes correction of the hyperthyroidism.\(^1,3,5,8\) Attacks can be prevented by maintaining euthyroid status with concurrent beta blockade.\(^3,4,8\) Some experts recommend acetazolamide, spirinolactone, and prophylactic low dose potassium supplementation.\(^1,8\)

Our patient promptly received the diagnosis of TPP, given her presenting features of limb pain and cramps for few days associated with hyperthyroid symptoms and symmetrical weakness in the setting of SAT with underlying Graves’ disease. Unique features in our patient include her gender, ethnicity, time lag between initial diagnosis of Graves’ disease, and the development of TPP and borderline low potassium levels, with the continuous need for prophylactic potassium supplementation. Though rare in African Americans, there have been isolated reports on this population, most of whom were males and in the recent years increasing number of reports on Caucasians and Hispanics are available.\(^6,10\) TPP could precede overt hyperthyroid symptoms in the non-Asian population, while it commonly occurs in known hyperthyroid patients in the Asian group. It is interesting to note that our patient was admitted with thyroid storm that lead to the diagnosis of Graves’ disease about 11 years prior to the onset of TPP. At the time, though, she did not develop any muscle weakness or pains. Recurrence of hyperthyroidism with SAT precipitated TPP in her case. Given that our patient had Graves’ disease for about 11 years, she promptly recognized the return of her hyperthyroid symptoms and sought medical attention immediately. Hence on examination she exhibited mild motor weakness, but not complete flaccid paralysis. Many authors have reported that the potassium levels during attacks are usually in the 1-3 \text{mEq/L} range at the time of presentation with flaccid paralysis.\(^2,12\) Our patient’s potassium was at the lower limit of normal and hence we believe she would have been overtly hypokalemic if she had presented later with flaccid paralysis. On the other hand, patients with TPP with normokalemia at the time of initial presentation have been reported. One such patient was found to have a recurrent episode with hypokalemia at the time of recurrence.\(^9\) Kufs et al., reported a TPP patient with normokalemic weakness at presentation, who few hours later developed paralysis with hypokalemia at that time.\(^6\) Interestingly, Wu et al., reported two patients with normokalemic TPP with potassium of 3.8 and 4.7, respectively at the time of flaccid paralysis.\(^13\) González-Treviño and Rosas-Guzman reported a patient with recurrent normokalemic flaccid paralysis eventually diagnosed with Graves’ disease. Their patient required glucocorticoids in addition to antithyroid treatment to ameliorate weakness.\(^14\) Just as in our patient, the above mentioned three patients had normal calcium and phosphorus levels too. We agree with Wu and González-Treviño and Rosas-Guzman that thyroid hyperfunction per se leads to weakness/paralysis, with effects on electrolytes including potassium, calcium, and phosphate contributing. Another unifying feature of normokalemic TPP discussed by González-Treviño and Rosas-Guzman in their report is the absence of typical precipitating events reported for hypokalemic TPP, such as heavy carbohydrate meal, exercise, alcohol intake, etc.
The other interesting feature in our patient is the continued need for prophylactic potassium supplementation. Various authors have conflicting views and recommendations on the role of potassium supplements in preventing attacks of TPP; some propose a definitive role, while others recommend avoiding potassium as prophylaxis.\(^8\) Our patient was started on low dose daily potassium supplementation, but when trying to stop it she experienced recurrence of weakness. Very few papers have commented on the duration of potassium supplementation in TPP. Kufs et al. recommend prophylactic potassium supplementation at the time of onset of weakness. Their patient required potassium supplementation to prevent relapse of paralysis despite antithyroid treatment.\(^6\) Our patient is currently on antithyroid medications, beta blocker, and low dose potassium. She still refuses radioiodine ablation and surgery and is being monitored regularly.

**Conclusion**

TPP is a life-threatening medical emergency. Though traditionally described in specific ethnic and gender groups with Graves’ disease, our patient in this case report reminds us that this potentially fatal condition has variable clinical presentations. It is important to recognize the condition early to reduce morbidity and mortality. Individual responses to treatment also vary.

**References**

1. Rhee EP, Scott JA, Dighe AS. Case records of the Massachusetts General Hospital. Case 4-2012: A 37-year-old man with muscle pain, weakness, and weight loss. N Engl J Med 2012;366:553-60.
2. Hsieh CH, Kuo SW, Pei D, Hung YJ, Chyi-Fan S, Wu LI, et al. Thyrotoxic periodic paralysis: An overview. Ann Saudi Med 2004;24:418-22.
3. Lam L, Nair RJ, Tingle L. Thyrotoxic periodic paralysis. Proc (Bayl Univ Med Cent) 2006;19:126-9.
4. Lin SH. Thyrotoxic periodic paralysis. Mayo Clin Proc 2005;80:99-105.
5. Kung AW. Clinical review: Thyrotoxic periodic paralysis: A diagnostic challenge. J Clin Endocrinol Metab 2006;91:2490-5.
6. Kufs WM, McBiles M, Jurney T. Familial thyrotoxic periodic paralysis West J Med 1989;150:461-3.
7. Ober KP. Thyrotoxic periodic paralysis in the United States. Report of 7 cases and review of the literature. Medicine (Baltimore) 1992;71:109-20.
8. Barahona MJ, Vinagre I, Sojo L, Cubero JM, Pérez A. Thyrotoxic periodic paralysis: A case report and literature review. Clin Med Res 2009;7:96-8.
9. Kodali VR, Jeffcote B, Clague RB. Thyrotoxic periodic paralysis: A case report and review of the literature. J Emerg Med 1999;17:43-5.
10. Magsino CH Jr, Ryan AJ Jr. Thyrotoxic periodic paralysis. South Med J 2000;93:996-1003.
11. Diedrich DA, Wedel DJ. Thyrotoxic periodic paralysis and anesthesia report of a case and literature review. J Clin Anesth 2006;18:286-92.
12. Sinharay R. Hypokalaemic thyrotoxic periodic paralysis in an Asian man in the United Kingdom. Emerg Med J 2004;21:120-1.
13. Wu CC, Chau T, Chang CJ, Lin SH. An unrecognized cause of paralysis in ED: Thyrotoxic normokalemic periodic paralysis. Am J Emerg Med 2003;21:71-3.
14. González-Treviño1 O, Rosas-Guzman J. Normokalemic thyrotoxic periodic paralysis: A new therapeutic strategy. Thyroid 1999;9:61-3.

**How to cite this article:** Kannan L, Kim YN. Thyrotoxic periodic paralysis in long standing Graves’ disease: An unusual presentation with normokalemia. North Am J Med Sci 2015;7:119-21.

**Source of Support:** Nil. **Conflict of Interest:** None declared.