

CASE REPORT

**THYROTOXIC PERIODIC PARALYSIS  
a case report and review of the literature**

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Thyrotoxic periodic paralysis (TPP) is an uncommon disorder characterized by simultaneous thyrotoxicosis, hypokalaemia, and paralysis and is the most common acquired form of periodic paralysis. It is usually associated with low plasma potassium levels and is often precipitated by physical activity or ingestion of carbohydrates. We presented a 35-year-old man with hyperthyroidism who admitted applied to the emergency department with an episode of flaccid quadriparalysis following oral diclophenac sodium usage for lumbar disk hernia and the review of the literature on this subject. Physical and laboratory examination revealed sinus tachycardia, diffuse toxic goiter, flaccid quadriparalysis, a low serum potassium level (1.51 mmol/L), ST segment depression, coincidental horseshoe kidney. Potassium chloride was admitted via both parenteral and orally. Meanwhile antithyroid treatment (propylthiouracil and propranolol) was also given. Early diagnosis is important for planning antithyroid treatment, protecting the patient from further episodes of paralysis and avoidance of precipitating factors. In our patient, electrolyte imbalance appeared secondary to polyuria and vomiting, serious pain and physical stress may have triggered TTP.

**Key words:** Thyrotoxic periodic paralysis, hypokalaemia, precipitating factors.

**INTRODUCTION**

Thyrotoxic periodic paralysis is an uncommon disorder characterized by simultaneous thyrotoxicosis, hypokalaemia, and paralysis and is the most common acquired form of periodic paralysis (1,2). 90% of all cases reported in the literature were constituted by Orientals (3,4). It has also been reported in Caucasians (5), native American Indians (6), Blacks (7) and Aborigines (8). Most cases are due to familial or primary hypokalaemic periodic paralysis; sporadic cases are associated with numerous other conditions including barium poisoning, hyperthyroidism, renal disorders, licorice ingestion, certain endocrinopathies, fistulas and gastrointestinal potassium losses (2,9,10).

We presented a 32-year-old man with hyperthyroidism who applied to the emergency department with an episode of flaccid quadriparalysis following diclophenac sodium application for lumbar disk hernia and review of the literature on this subject.

**CASE**

The 35-year-old man was admitted to the emergency department because of diffuse weakness, nausea, vomiting and palpitation. At that day he didn't eat extraordinary meal and any fluid replacement including glucose hadn't been applied to him. The patient had only taken 225 mg diclophenac sodium (intramuscularly) himself during the last 5 hours for the lumbar disk hernia without prescription. At night, 30 minutes after the last injection, he was complained from polyuria and vomiting. Approximately 10 hours after the diclophenac injection, quadriparalysis had suddenly appeared. The patient was suffered from lumbar disk hernia for four years and he had never used diclophenac preparations before. It was learned from his brief history that, weight loss (about 10 kg), fatigue, diarrhea, heat intolerance, nervousness, insomnia and palpitation had appeared during the last year and his two brothers had also goiter. Physical examination revealed diffuse thyromegaly, mild exophthalmos without lid lag, normal S<sub>1</sub> and S<sub>2</sub>, absence of deep tendon reflexes in the upper and lower extremities, 0/5 motor strength in his upper and lower extremities, common anxiety. Vital signs were as follows: blood pressure; 90/60 mmHg, heart rate; 130/min, respirations; 40/min and body temperature; 37°C.

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Complete blood cell count and electrolyte levels were normal except for a serum potassium level of 1.51mmol/L (normal, 3.3-5.1mmol/L). In addition, patient had serum creatine phosphokinase level of 1200 U/L (normal, 0-190 U/L), serum triiodothyronine ( $T_3$ ) level of 2.33 ng/ml (normal, 0.846-2.02 ng/ml), serum thyroxine ( $T_4$ ) of level 17.78 ng/dl (normal, 5.13-14.06 ng/dl), serum free  $T_3$  level of 0.797 ng/dl (0.182-0.462 ng/dl), serum free  $T_4$  level of 5.09 ng/dl (normal, 0.932-1.71 ng/dl), serum thyroid-stimulating hormone (TSH) level of 0.005  $\mu$ IU/ml (normal, 0.27-4.2  $\mu$ IU/ml). Electrocardiogram has showed sinus tachycardia and ST segment depression (in  $V_{1-4}$ ). Ultrasonography showed diffuse goiter and horseshoe kidney. The patient was hospitalized due to hypokalaemic paralysis and Graves' disease.

The patient has received 106 mEq intravenous (iv) potassium chloride during first six hours. Then he received oral potassium chloride (80 mEq/day). Meanwhile propylthiouracil (200 mg/day) and propranolol (40 mg/day) were given to him. Serial measurements of potassium levels showed a steady return to normal value (3.55 mmol/L) within 8 hours. The improvement began 30 minutes after potassium application and the patient's muscle strength came back to normal on the fingers of the lower extremity firstly then on arms and at last on legs. Within 10 hours of admission, paralysis had completely resolved. Deep tendon reflexes were slowly returned and complete improvement occurred within 18 hours. After 6 hours of admission, electrocardiographic data were determined as normal. He was discharged from the hospital on the 2<sup>nd</sup> day with normal motor strength and normal reflexes.

## DISCUSSION

TPP is predominantly a disease of males, the male: female ratio being 20:1 (3,8). The usual age of onset of the disorder is similar to that of thyrotoxicosis, as being most common between second and fourth decades (3). Rarely, there is family history of TPP (3,6). Our patient was a 35-year-old man and there wasn't any family history.

The pathogenesis of TPP is uncertain, although it likely involves defects in membrane bound ion-transporting proteins, such as sodium, K-adenosine triphosphatase (11), or ion channel proteins (12). Marlier et al (13) claimed that the activity of erythrocyte Na-K-ATPase was significantly decreased before treatment in a patient with TPP.

Chan et al (14) have been determined that patients with TPP have hyperinsulinaemia and this is accompanied by higher Na<sup>+</sup>, K<sup>(+)</sup>-ATPase activity. TPP usually follows a heavy carbohydrate meal and this has been explained by hyperinsulinaemia stimulating Na<sup>+</sup>, K<sup>(+)</sup>-ATPase activity. Total body potassium stores in TPP remains adequate, but serum potassium decreases due to potassium migration into muscle cells which causes the muscles to become electrically unexcitable (2).

Graves' disease is the most common cause of hyperthyroidism in affected patients, but any cause of thyrotoxicosis, including administration of excessive amounts of exogenous thyroid hormone, can trigger attacks of TPP in susceptible patients (2). TPP has been described in patients with nonimmunologic thyroid diseases, such as toxic nodular goiter and toxic adenoma. (1,15-17). Paralytic attacks can be induced by insulin and carbohydrate administration in hyperthyroid patients with TPP, but not in patients with TPP who have become euthyroid. After patients with TPP have become euthyroid and symptom-free, paralytic attacks will recur if patients relapse into a thyrotoxic state (3). Biering et al (18) reported thyrotoxic periodic paralysis in two patients with adrenal adenomas and hyperandrogenaemia.

It was reported that diclophenac sodium caused hyperkalaemic quadriplegia (19), anaphylactic shock (20), severe hepatitis (21) and arterial vasospasm (22), and was a potent inhibitor of prostaglandin  $E_2$  (PG- $E_2$ ) and IL-6 (23). In our case, profound hypokalaemia and quadriplegia were determined despite known hyperkalaemic effect of diclophenac sodium. In this case, possibly excessive amounts of thyroid hormone increased electrolyte permeability of the muscle membrane to electrolytes, with influx of K into the cell so caused failure in depolarization. Other causes of hypokalaemia are electrolyte imbalance secondary to polyuria and vomiting. At the same time, serious pain and stress related to lumbar disk hernia may have triggered TTP.

Some patients complain muscular weakness, especially proximal muscles of the lower extremities, while marked and generalized weakness of skeletal muscles is common with more severe potassium depletion (2,16,17). Attacks of periodic paralysis occur usually at night. Very severe hypokalaemia may lead to virtually total paralysis including respiratory, bulbar and cranial musculature. Sudden deaths from respiratory failure and arrhythmia have

been reported (1,2,9,24,25). On physical examination, in addition to decreased motor power, the patient may demonstrate decreased or absent tendon reflexes. The sensations and level of consciousness are generally unaffected (2). Our patient was conscious, any important respiratory or cardiac problems haven't been seen, but deep tendon reflexes were absent together with quadriparesis. Both of the problems improved completely after potassium replacement. In our case, TPP occurred at night after polyuria, vomiting and serious lumbar pain following intake of a total of 225 mg diclofenac sodium in about 5 hours.

The most frequent electrocardiographic changes were ST segment depression with T wave flattening, sinus tachycardia, and U waves, which are typical for hypokalaemia and thyrotoxicosis. In patients with TPP, sinus arrest and second-degree atrioventricular block (26), ventricular fibrillation (25), and ventricular tachycardia (27) have been described. Electrocardiogram of our case showed sinus tachycardia and ST segment depression ( $V_{1-4}$ ). Hypophosphatemia and hypomagnesaemia during paralysis in patients with TPP have been previously reported (1,28,29) and may contribute to the muscle weakness (30) along with hypokalaemia. In our patient, any other electrolyte imbalance other than profound hypokalaemia was not detected.

Hypokalaemia is considered to be the most consistent electrolyte abnormality in TPP and a hallmark of the syndrome, along with hyperthyroidism. It has been demonstrated that hypokalaemia is a result of a K shift into cells and that it is not caused by total-body K depletion and exact mechanism is unknown (16,17,31). Correction of the hyperthyroid state is the most definitive treatment for TPP. Hyperthyroidism was managed first with a thyroid suppressant (methimazole) and propranolol (1,3,5,32,33).

Potassium administration during an acute attack will shorten the duration of the episode, and treatment with prednisone, potassium supplementation, or spironolactone may prevent attacks in some patients (9,32,33). Definitive treatment of hyperthyroidism was achieved with radioactive iodine. Our patient received totally 106 mEq potassium chloride and recovered in about 6 hours after arriving to the hospital. 200 mg/day propylthiouracil and 40 mg/day propranolol were given orally to our patient.

TPP should be taken into consideration in the differential diagnosis of all acute episodes of motor paralysis especially in young patients. TPP is treated by cautious replacement of potassium and achievement of a euthyroid state. Early diagnosis is important to prevent morbidity and mortality, early treatment protect the patient from further episodes of paralysis and avoid from precipitating factors.

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