Case Report

Postoperative thyroid storm after radical nephrectomy for renal cell carcinoma with inferior vena cava tumor thrombus

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Abbreviations
Af = atrial fibrillation
CT = computed tomography
ICU = intensive care unit
IVC = inferior vena cava
POD = postoperative day
RCC = renal cell carcinoma
TS = thyroid storm
TSH = thyroid-stimulating hormone

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Introduction: Thyroid storm is a rare life-threating condition. We report a case of thyroid storm after radical nephrectomy for renal cell carcinoma with inferior vena cava tumor thrombus.

Case presentation: A 76-year-old man with a left renal tumor and tumor thrombus extending into the inferior vena cava underwent left radical nephrectomy and thrombectomy. After the surgery, his postoperative course rapidly deteriorated, including central nervous system disturbance, fever, tachycardia, congestive heart failure, and hepatic manifestation. Thyroid function test revealed perioperative hyperthyroidism. Corticosteroids and inorganic iodide improved his condition, suggesting that he developed thyroid storm after surgery. He was discharged 5 months after surgery and has been free from disease recurrence for more than 2 years.

Conclusion: Thyroid storm after surgery is rare. However, this postoperative complication is important because it is fatal if not diagnosed and treated properly.

Key words: complication, hyperthyroidism, postoperative, thyroid storm.

Keynote message

We report a rare case of TS after surgery. This postoperative complication is fatal if not diagnosed and treated properly. Physicians should pay attention to control of the perioperative thyroid function.

Introduction

TS is a rare life-threating condition induced by the excessive release of thyroid hormones.[1] The overall incidence rate is 0.20–0.76/100,000 persons per year and that induced by nonthyroid surgery is low, accounting for approximately 2.6%[2,3] of all TS events. The mortality rate is 10–25%,[2,4] and proper diagnosis and appropriate treatment are necessary. We describe a case of TS after surgical resection for renal cell carcinoma with inferior vena cava thrombus, in which intensive care management across multiple disciplines was required.

Case presentation

A 76-year-old man visited the local hospital because of fatigue and fever. As CT revealed a 6-cm left renal tumor, he was referred to the second hospital for further treatment and laparoscopic radical nephrectomy was planned. However, he was referred to the third hospital because tumor thrombus rapidly grew and extended into the IVC during the 1-month waiting period. Then, percutaneous needle biopsy of the renal mass was performed and papillary RCC was suspected on pathology.

Considering the necessary backup by a vascular surgeon, he was referred to our hospital for definitive surgery. On CT, a 7-cm left renal tumor with tumor thrombus extended into the IVC above the hepatic vein but below the diaphragm (Fig. 1a,b). As he was free from distant

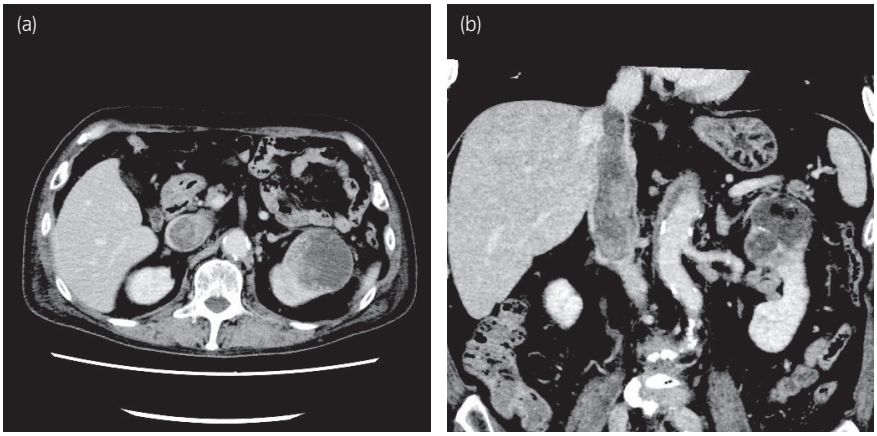

Fig. 1 Enhanced computed tomography. (a) Left renal tumor. (b) Thrombus extending into the IVC to above the hepatic vein but not to the diaphragm.

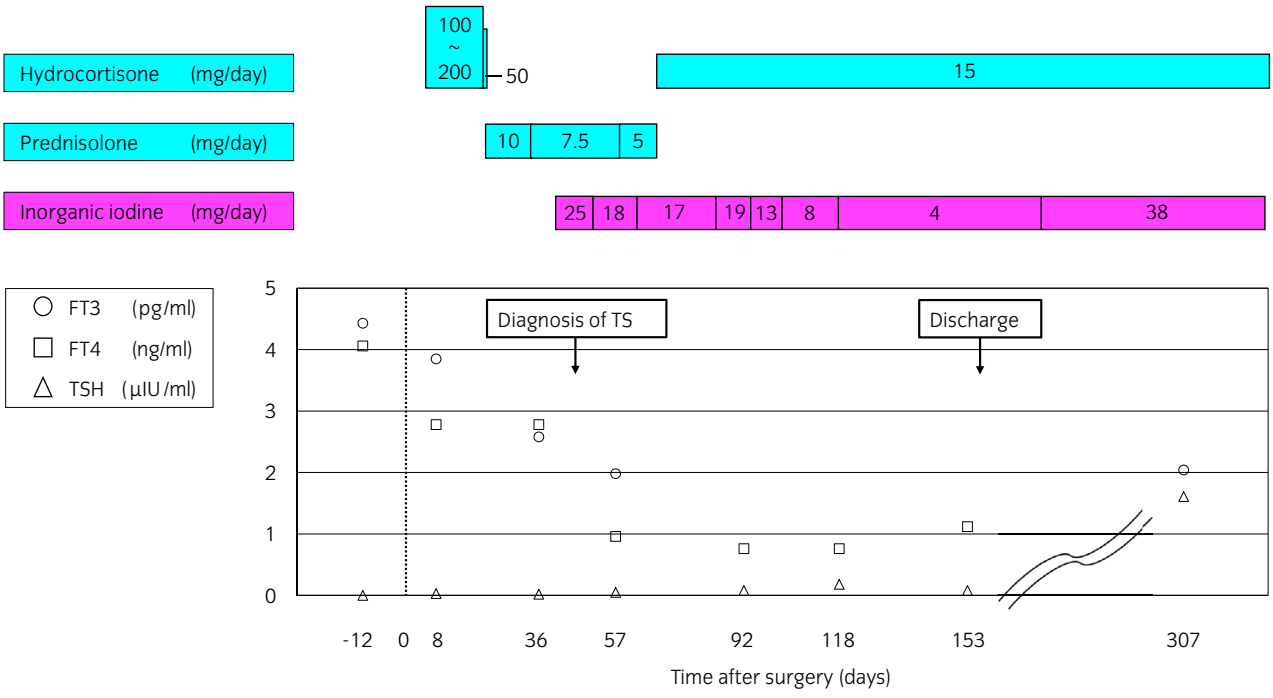

Fig. 2 The clinical course. The levels of thyroid hormones gradually normalized. FT3: Free T3 (2.1 - 3.8 pg/mL), FT4: Free T4 (0.82–1.63 ng/mL), TSH: Thyroid-stimulating hormone (0.38–4.31 μIU/mL).

metastasis, his clinical stage was cT3bN0M0, level III tumor thrombus (Mayo classification[5]). After presurgical treatments of heparinization and axitinib (8 days), left radical nephrectomy and thrombectomy were performed via a thoracoabdominal incision. The left adrenal gland was removed together. The total operating time was 11 h and 18 min. Blood loss was 2340 mL. The total volume of blood transfused was 3080 mL (1400 mL of red cell concentrate and 1680 mL of fresh frozen plasma). On POD 2, the serum bilirubin level increased to 4.6 mg/dl and he developed Af, which was controlled by intravenous injection of aprindine (100 mg). On POD 3, Af recurred in conjunction with high fever, and intravenous verapamil (5 mg) and cefepime (0.5 g every 12 h) were administered. On POD 4, his condition further deteriorated, with an increase in the serum bilirubin level to 7.4 mg/dl and respiratory failure (SaO_2 90% on 5 L of FiO_2 100%), and he remained hypotensive after noradrenaline (0.1 μg/kg/min) support; therefore, he was transferred to the ICU. His consciousness level was markedly impaired. CT revealed aspiration pneumonitis. He was intubated and antibiotics were changed to meropenem (0.5 g every 12 h). However, he did not respond to these treatments. On POD 6, after the administration of hydrocortisone (200 mg/day) for suspected adrenal insufficiency associated with severe sepsis, his hemodynamic state stabilized. Due to a high serum potassium level of 6.1 mEq/L and blood urea nitrogen level of 98 mg/dL, he required 7 days of continuous hemodiafiltration. His consciousness level and overall status gradually improved. On POD 16, noradrenaline was discontinued, but hydrocortisone was continued. He was weaned from ventilatory support on POD 20 and discharged from the ICU on POD 22. As mild disturbance of consciousness remained, we consulted the neurologist and endocrinologist. Based on the high perioperative levels of thyroid hormone (Fig. 2, preoperative: free T3

4.06 pg/mL and free T4 4.43 ng/mL; POD 8: free T3 3.85 pg/mL and free T4 2.78 ng/mL; normal range: free T3 2.1–3.8 and free T4 0.82–1.63) and other typical symptoms, including impaired consciousness, fever, and tachycardia, during the postoperative course, hyperthyroidism was suspected. Reexamination of thyroid function revealed that the free T3 level was 2.58 pg/mL, the free T4 level was 2.78 ng/mL, TSH was suppressed to 0.02 μIU/mL (normal range: 0.38–4.31), and both TSH receptor antibody and thyroid-stimulating antibody were positive. He was diagnosed with hyperthyroidism.

After the initiation of inorganic iodide (25 mg/day), the thyroid hormone levels normalized with improvement in consciousness. Pathological examination demonstrated papillary RCC. He was discharged 5 months after surgery because of rehabilitation and remains free from disease recurrence for more than 2 years.

Discussion

TS is a life-threatening situation with severe clinical manifestations of thyrotoxicosis. Typical symptoms are central nervous system disturbance, fever, tachycardia, congestive heart failure, and gastrointestinal hepatic manifestation. The most common cause of TS is the irregular use or discontinuation of antithyroid drugs. Standard therapy for TS consists of multiple medications such as corticosteroids, antithyroid drugs, and inorganic iodine.[6] TS can also be caused by medical procedures such as thyroid surgery and nonthyroidal surgery. The rate of thyroid or parathyroid surgery is 8.6% in patients with thyrotoxicosis in the United States.[3] However, no cases of TS were caused by thyroid surgery in a Japanese survey because of improvements in the management of patients with thyrotoxicosis before thyroid surgery.[2] TS after nonthyroidal surgery is also rare, but TS after coronary artery bypass surgery has been reported.[7,8] Treatment using antithyroid drugs, beta-blockers, and high-dose steroids was reported in a patient without a history of hyperthyroidism.

In the present case, during the rapid deterioration after surgery, we did not suspect TS. Based on a suggestion from the neurologist and endocrinologist after ICU discharge, we reexamined the thyroid function, revealing hyperthyroidism. Retrospectively, he had typical symptoms of TS, including central nervous system disturbance, fever, tachycardia, congestive heart failure, and hepatic manifestation in the ICU. Taken together with the improvements after the administration of corticosteroids and inorganic iodide, we considered that he developed TS after surgery. His general condition improved after corticosteroid administration, which was the turning point in his TS recovery. Corticosteroids inhibit both thyroid hormone synthesis and peripheral conversion of T4 to T3,[9] and should be administered for relative adrenal insufficiency caused by TS. There is a possibility that the discontinuation of steroid-containing medication caused indolent thyroiditis and adrenal insufficiency. He was receiving betamethasone and d-chlorpheniramine for allergies; however, these drugs were discontinued before referral to our hospital. Although the blood examination before axitinib administration revealed an increase in free T3 and free T4 levels (free T3: 4.06 pg/mL, free T4: 4.43 ng/mL), we did not consider it to be a problem.

In the present case, we administered axitinib during the waiting period before surgery because we were concerned about the thrombus rapidly growing above the diaphragm. However, tyrosine kinase inhibitors, including axitinib, may influence thyroid function. As neoadjuvant therapy with tyrosine kinase inhibitors is often administered to renal cell carcinoma patients with tumor thrombus,[10,11] physicians should pay attention to control of the preoperative thyroid function. The present case demonstrated that the important step in diagnosis is "to suspect TS based on typical symptoms."

Conflict of interest

The authors declare no conflict of interest.

Approval of the research protocol by an institutional reviewer board

Not applicable.

Informed consent

Informed consent was obtained from the patient.

Registry and the registration no. of the study/trial

Not applicable.

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