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Immediate Thyroid Crisis after Radio Frequency Ablation of Autonomously Functioning Thyroid Nodule

Abbreviated title: Immediate Thyroid Crisis after RFAblation

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Abstract

Radiofrequency ablation (RFA) is acknowledged as an effective and safe technique for the treatment of benign thyroid nodules. However, there have recently been reports of thyroid dysfunction related to this technique, especially thyrotoxicosis. Here, we report a case of a 34-year-old woman's thyroid crisis immediately (about 20 minutes) after RFA for an autonomous functional thyroid nodule. Fortunately, her symptoms improved with treatment (hydration, corticosteroid, propylthiouracil, and propranolol), and after three days, she was discharged from the hospital in good condition.

Keywords: Radiofrequency ablation, Thyroid nodule, Thyrotoxicosis, Thyroid crisis.

Key points:

RFA can be an effective treatment for large (30 mL) autonomously functioning thyroid nodules.

Thyroid storm could occur in a fraction of patients who underwent RFA for autonomously functioning thyroid nodules.

During RFA for autonomously functioning thyroid nodules, clinical symptoms of thyrotoxicosis must be carefully monitored.

Introduction

Thyroid nodules are common in the general population and are being detected more frequently recently due to the widespread use of ultrasound (1). The prevalence of thyroid nodules is 4–7% clinically and 30–70% sonographically in different populations (2). Half of the thyroid nodules have autonomously functioning thyroid nodules (AFTN), and approximately 10% of thyroid nodules are "Hot" on thyroid scans (3). Hyper-functioning thyroid nodules should be treated because of several side effects, particularly on the skeletal and cardiovascular systems (4).

The disease cannot be cured with anti-thyroid medication; The standard of care is surgery and radioiodine. The surgery has several complications, including hypoparathyroidism, wound infection, laryngeal injury, scarring, and trauma to adjacent structures. Another option for treatment is radioactive iodine, but it comes with several drawbacks and risks, including contraindications during pregnancy and breastfeeding, hypothyroidism, and the possibility of secondary malignancy in the future. A minimally invasive outpatient procedure called radiofrequency ablation (RFA) uses heat energy to cause coagulative necrosis in the target tissue. This method was first applied to the ablation of benign thyroid nodules in 2006, and studies demonstrated that it could reduce nodule volume by 50–80% (5). The side effects of this technique were very low (2–4%) in different studies. Major complications (1–2%) are laryngeal nerve injury, brachial nerve injury, Horner's syndrome, and nodular rupture; minor complications include pain in the treated area, skin burns, and hematoma (6). However, recent case studies suggest some thyroid dysfunction, particularly thyrotoxicosis with RFA of thyroid nodules (2–4, 7). The possibility of this complication

was observed more frequently in the first week of the procedure (7). However, we reported the first case of immediate thyrotoxicosis in a patient who received RFA for AFTN.

Case Report

The patient was a 34-year-old woman with a history of hyperthyroidism due to AFTN for two years before her admission. She was being treated with methimazole 20 mg daily. However, each time her doctor tapered her methimazole, she suffered from palpitations, tremors, and agitation. The doctor recommended radioactive iodine therapy, but the patient refused because of fears of hypothyroidism.

As another option, she was referred to a radiologist for RFA. Thyroid ultrasonography before RFA showed a 34×49×43mm (30 mL) well-defined isoecho cystic solid (about 70% cystic) nodule without calcification with peripheral vascularity and soft elasticity at the lower pole of the right lobe (TIRADS 3) and no lymphadenopathy. The patient underwent RFA followed by hydro-dissection, and using a 10 mm active-tipped HF needle, 6 mL of absolute ethanol was also injected into the cystic component.

Her thyroid function before RFA was: TSH= 0.11 micIU/ml (normal range: 0.3–5), Total T4= 62.6 ng/ml (normal range: 50–120), Total T3= 1.7 ng/ml (normal range: 0.8–2), freeT4= 1.3 (0.8–1.8 ng/dl)

The patient developed restlessness, agitation, tachycardia with a heart rate of 125 beats/min, tremors, headache, chest discomfort, nausea, vomiting, abdominal pain, and diarrhea 20 minutes after the RFA.

She was referred to the hospital with the impression of a thyroid storm. In the initial examination, the patient was febrile (body temperature: 38.8°C) with a heart rate of 125 beats/min, a blood pressure of 130/80 mmHg, and a respiratory rate of 18/min. Laboratory data revealed a low level of TSH; 0.1 mIU/ml (normal range: 0.3–5 mIU/ml), elevated total T4; 160 ng/ml (normal range: 50–120 ng/ml), and total T3; 2.5 ng/ml (normal range: 0.8–2 ng/ml).

The patient received hydration therapy, intravenous hydrocortisone 100 mg/IV/TDS, tab propylthiouracil (PTU) 200 mg/QID, and tab propranolol 20 mg/QID. Cardiac monitoring and pulse oximetry were performed. Her symptoms improved after three days of treatment. The patient was discharged in good condition from the endocrine ward on prednisolone 30 mg/day, methimazole 40 mg/day, and propranolol 30 mg/day. At discharge, thyroid ultrasonography showed a solid cystic isoecho well-defined nodule (26×18mm) without calcification and multiple reactive lymph nodes with the largest size of 2.5mm (Fig 1).

Prednisolone and propranolol tapered to discontinue in one month. Methimazole was also tapered to discontinue in three months. After three months of RFA, thyroid ultrasonography indicated a significant decrease in volume: 36×19×25mm (9.3 mL) and without lymphadenopathy (Fig 2).

Discussion

To the author's knowledge, this is the first case report in which a thyroid storm based on Japanese criteria (8) occurred 20 minutes after RFA for an autonomous functional thyroid nodule. Fortunately, the symptoms improved by treatment without any sequela. However,

three months later, thyroid ultrasound showed decreased thyroid nodule volume, suggesting that RFA might be effective even in large autonomic nodules.

RFA is generally safe and well-tolerated in treating benign thyroid nodules (5). However, there is no consensus in guidelines for indicating RFA in AFTN. RFA is recommended as a treatment option for AFTN by the majority of guidelines other than the National Institute for Health and Care Excellence (NICE) (9); however, the criteria for nodule size vary from one guideline to the next (10). For example, the Austrian Societies (11) do not recommend RFA for large (>15 mL) or multifocal AFTNs, while the Italian Scientific Societies (12) recommended the same in combination with radioiodine treatment for autonomic thyroid nodules larger than 20 mL.

Thyroid storm is a relatively uncommon side effect of RFA in treating thyroid nodules (2–4, 7, 13). The retrospective cohort study conducted between 2013 and 2017 of 99 patients with benign thyroid nodules treated with RFA, four developed thyroiditis, and three transient hyperthyroidism during the first month of RFA (2). In another multicenter prospective study of 345 patients with benign thyroid nodules undergoing RFA, only one patient developed transient hyperthyroidism one month after RFA that was treated with propylthiouracil 100–150 mg daily (4). Bernardi et al. conducted a study comparing RFA and surgical treatment for thyroid nodules, One patient experienced brief thyrotoxicosis three months after RFA, but it resolved spontaneously within a month (13). In 2021, Whang et al. conducted a study of the incidence of thyroid dysfunction within one week, 1, 6, and 12 months after RFA. Of 75 euthyroid patients who received RFA for symptomatic benign thyroid nodules, approximately 47% experienced some type of thyroid dysfunction

(overt thyrotoxicosis, subclinical thyrotoxicosis, and subclinical hypothyroidism) during the study. The peak of thyroid dysfunction was observed within a week and resolved over 1–12 months (7).

Consistent with previous studies, our patient suffered thyrotoxicosis while undergoing RFA for AFTNs, but complications occurred immediately after the procedure. This finding implies that a thyroid storm's clinical and laboratory findings could occur in a fraction of the time after receiving an RFA for thyroid nodules. Therefore, RFA can be an effective treatment for thyroid nodules, and increased awareness of this potentially serious side effect is warranted. During RFA for autonomously functioning thyroid nodules, clinical symptoms of thyrotoxicosis must be carefully monitored.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Figure 1. Ultrasonography of thyroid nodule at discharge. Thyroid ultrasonography showed a solid cystic isoecho well-defined nodule (26×18mm) without calcification as well as multiple reactive lymph nodes with the largest size of 2.5mm.

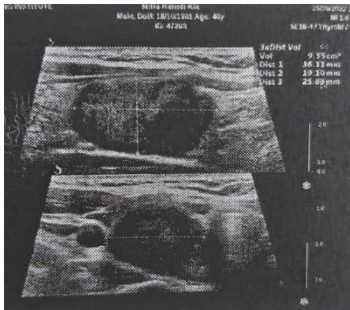


Figure 2: Ultrasonography of thyroid nodule three months after RFA. Thyroid ultrasonography indicated a significant decrease in volume: 36×19×25mm (9.3 mL), without lymphadenopathy.

Consent for publication

The consent for publication was obtained from the patients.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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