

Microwave Ablation of An Autonomous Functioning Thyroid Nodule in A Pregnant Patient: A Case Report

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Abstract: An autonomous functioning thyroid nodule (AFTN) is a benign disease. It can autonomously secrete excessive thyroid hormones without the need for TSH stimulation. It is not subject to the hypothalamic-pituitary-thyroid axis and is rare during pregnancy. Here we report a case of a 36-year-old pregnant woman with hyperthyroidism detected in early pregnancy. According to ultrasound and laboratory results, she was diagnosed with an AFTN. Ultrasound-guided (US-guided) microwave ablation (MWA) was used to treat AFTN during the second trimester of pregnancy. Hyperthyroidism crisis and other complications did not occur due to MWA. Thyroid function was normal at 2, 3 and 4 months after MWA. The volume reduction rate (VRR) was 83.67% at 4 months after MWA. The patient gave birth normally at 40 weeks gestation. All indices of thyroid function were normal during postpartum and lactation. US-guided MWA is a feasible and safe method for the treatment of AFTN during pregnancy, specifically in the second trimester.

Key words: Microwave ablation; Autonomous functioning thyroid nodule; Pregnancy; Thyroid function

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The overall prevalence of gestational thyrotoxicosis is 1% [1], and the rate of thyrotoxicosis caused by an autonomous functioning thyroid nodule (AFTN) is less than 5% [2]. Ultrasound-guided (US-guided) microwave ablation (MWA), a new development for the treatment of thyroid diseases, has the advantages of being minimally invasive, safe, and effective [3-7]. MWA of thyroid nodules during pregnancy, however, has not been reported. In 2018, our team carried out MWA of an AFTN on a pregnant female patient.

Case Report

A 36-year-old female patient had been diagnosed with a thyroid nodule (2cm in size) 2 years before the operation, and did not detect the thyroid function at

that time. She was diagnosed with abnormal thyroid function during a routine pregnancy examination at China-Japan Friendship Hospital on the third day of the ninth week of pregnancy. The results showed as following: serum thyrotropin (TSH) <0.005 mIU/L (0.27–4.20 mIU/L); third-generation free T3 (FT3) 6.21 pg/ml (1.80–4.60 pg /ml); free T4 (FT4) 25.6 pmol/L (12.00–22.00 pmol/L); Thyrotropin Receptor Antibody (TRAb) <0.3 mIU/mL (0–1.75 mIU/mL); thyroid peroxidase antibody (TPOAb) 23.5 IU/ml (0–34.00 IU/mL); and thyroid globulin antibody (TgAb) 502.00 IU/mL (0–85.00 IU/mL).

Ultrasound (US) examination (10.0MHz linear probe, Aplio 500, Toshiba Medical Systems, Tokyo, Japan) revealed a hypoechoic nodule in the left lobe of the thyroid gland, about 3.9 × 1.9cm in size, with clear

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boundaries, uniform echogenicity[8], and no abnormal blood flow (Fig. 1). The patient had no symptoms of palpitations, hyperhidrosis, emaciation, prominent eyeballs, or serious gestational reaction.

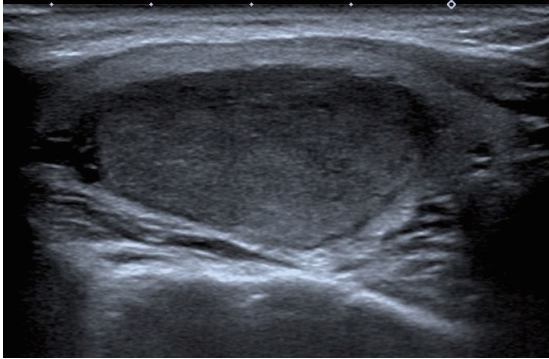


Figure 1 A hypoecho nodule on the left lobe of thyroid was found, with clear boundary, about 3.9×1.9 cm in size.

On June 23, 2018, the patient received US-guided thyroid nodule needle puncture. The cytological and pathological results confirmed as thyroid adenoma. AFTN was conducted by endocrinology, general surgery, and obstetrics and gynecology department. Five options were provided to the patient and her family: surgery, medication, thermal ablation (such as MWA), iodine-131 treatment, or no treatment. The patient was a middle-aged pregnant woman on her first pregnancy. She and her family refused medications and surgery due to the impact of drugs on fetal growth and development, and chose MWA. To ensure the safety of the patient and the fetus, invasive treatments, even minimally invasive ones, should not be carried out in the first trimester of pregnancy. To avoid the risk of hyperthyroidism occurring after MWA, she took 50mg propylthiouracil tablets twice daily (BID) to control the thyroid hormone levels. After 5 weeks, TSH, FT3 and FT4 were 0.006 mIU/L, 3.05 pg/mL, and 18.51 pmol/L, respectively. Moreover, the patient was in the second trimester of pregnancy. So it was safe for her to suffer MWA.

On July 31, 2018, the patient received US-guided MWA. Ropivacaine diluted in normal saline at a ratio of 1:3 was administered along with locally infiltrated anesthesia to alleviate pain during the operation. A microwave generator and a 17 gauge internally cooled antenna with a 0.4cm needle tip (Intelligent Basic Type Microwave Tumor Ablation System, Nanjing ECO Microwave System, Nanjing, China) were used in MWA. During the process of the treatment, the operators and nurses closely monitored the heart rate of the patient and the fetus. The patient had no obvious discomfort. Due to adequate preoperative preparation, there was no postoperative hyperthyroidism crisis or complications.

The aim of the follow-ups was to monitor the thyroid function. After 3 weeks, the TSH and FT4 were 4.2 mIU/L and 10.42 pmol/L, respectively. These indicators showed temporary subclinical hypothyroidism. Euthyrox (25 μ g; Levothyroxin Sodium Tablets, Merck serono co. LTD, Germany) was given orally once daily (QD) [9]. Thyroid function was followed up again at 2 months after ablation, and Euthyrox was withdrawn. All laboratory indicators were normal starting three months after intervention. Four months after ablation, US showed that the nodules had shrunk to approximately 1.9×1.1 cm (Fig. 2). The volume reduction rate (VRR) was 83.67%. No fetal malformations were observed during the pregnancy.

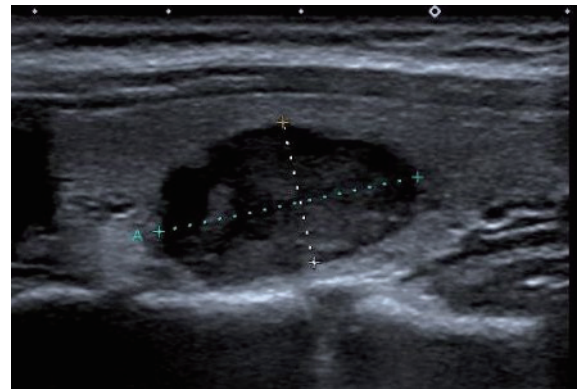


Figure 2 Four months after MWA. The nodule had shrunk from 3.9×1.9 cm to 1.9×1.1 cm. The volume reduction rate (VRR) was 83.67%.

On Jan 25, 2019, the patient gave birth. All indicators of thyroid function were normal in the postpartum examination.

The patient gave an informed written consent to publish this case.

Discussion

An AFTN can autonomously secrete excessive thyroid hormones without TSH stimulation. It is not regulated by the hypothalamic-pituitary-thyroid axis. Normal thyroid secretion function might be suppressed by AFTNs, and the volume of the thyroid would shrink. AFTNs accounts for about 9% of thyrotoxicosis, and is more rare in pregnant women [10,11].

It is not difficult to diagnose an AFTN according to thyroid static nuclide scans, thyroid function laboratory tests, and US examination. An AFTN can be identified by thyroid US manifestations combined with TRAb, when radionuclide examination cannot be performed, such as during pregnancy or lactation, or with recent iodine exposure [12]. As the patient was unable to undergo radionuclide examination because of her pregnancy, we relied on two diagnostic tools: (1) laboratory tests, which showed a combination of decreased TSH, increased FT3

and FT4, and normal TRAb; (2) US manifestations, which indicated hyperthyroidism characterized by diffuse enlargement of the thyroid gland with heterogeneous changes and abundant blood flow signals [13]. However, US manifestations of this patient showed that the echo of thyroid tissues outside the nodule was uniform, and no abnormal blood flow signals were observed.

Surgical operation, radioactive iodine-131, drugs, and MWA have been used to treat AFTNs. Before ablation, we provided five treatment options to the patient.

- Surgical resection: (1) surgical resection after induced abortion for patients during early pregnancy; (2) surgical resection performed during the second trimester of pregnancy, although severe surgical trauma may induce hyperthyroidism crisis.

- Drug treatment: oral prothiouracil tablets. Different from Graves' disease, the autonomic secretion of AFTNs are not easily alleviated by anti-thyroid drugs, and the thyroid hormone synthesized before treatment is stored in the gland, so it is impossible to completely control thyrotoxicosis with anti-thyroid drugs alone within weeks or months. Drug therapy can be administered during the whole pregnancy, and the drugs may affect the fetus through the placental barrier, possibly having a teratogenic effect. Drugs could also increase the risk of adverse reactions in the pregnant woman, such as maternal granulocytopenia, toxic liver disease, or vasculitis [14].

- Thermal ablation during the second trimester: Although possible, no previous publications have reported thermal ablation of thyroid nodules during pregnancy.

- Iodine-131 treatment: Radioactive examinations and treatment are prohibited during pregnancy.

- No treatment: Thyrotoxicosis can increase the risk of stillbirth, preterm birth, preeclampsia, pregnancy-related hypertension syndrome, abortion, intrauterine developmental delay, and premature babies, among other conditions [15].

The patients and her family chose MWA, which was best to meet their treatment demands. There were no adverse effects on the patient or her fetus that could be attributed to MWA during the follow-up. This treatment method is suggested to have the following advantages: (1) Thermal ablation is less harmful to pregnant women than traditional surgery; (2) ropivacaine is high protein-binding rate, the smallest placental volume, and low cardiac toxicity, so it can be used for local anesthesia; (3) MWA can fix the abnormal thyroid function; (4) unlike liver tumor ablation, thyroid nodule ablation causes little inflammatory reaction in the organs, and not enough to cause the heat absorption in the body [16]. The minimal inflammatory reaction may be due to a low concentration

of inflammatory factors in the blood that is unable to cause an immune reaction in the body; therefore, having little impact on the fetus; (5) the treatment did not cause abortion, and no fetal malformation was found by routine examination. However, long-term impact on the fetus still has to be confirmed by long-term follow-up after birth. Future additional cases with similar treatments should also be monitored to validate these findings.

Previous studies have confirmed that after surgical treatment of AFTNs, the residual thyroid tissue resumed its secretory function within two weeks [17]. After removal of adenoma, the level of thyroxine in blood decreased significantly, and the feedback inhibition of the pituitary gland was relieved. Under the stimulation of TSH, the inhibited thyroid tissue gradually restores its function. The inhibited thyroid tissue of the patient in this case did not recover its function until the third week after MWA, and temporary hypothyroidism occurred in combination with a T4 half-life of 7 days. We believe that re-examination of thyroid function at 2–4 weeks after MWA is important than any earlier assessment [11].

It is believed that hyperthyroidism during pregnancy increases premature abortion, miscarriage; hyperthyroidism increases neurological intelligence development in the fetus, pregnancy-related hypertension, hyperthyroidism, fetal growth restriction, stillbirth, and the risk of complications. Thus, active treatments should be given to pregnant patients diagnosed with hyperthyroidism. MWA and anesthesia themselves have little impact on pregnant women, but may lead to fetal miscarriage, premature birth, and other consequences. To minimize such risks, interventions should be undertaken in the second trimester. In addition, hypothyroidism during pregnancy may lead to abortion, premature birth, and other problems, so patients with temporary hypothyroidism after MWA should be promptly given thyroxine replacement therapy.

This case suggests that the routine examination of thyroid function before pregnancy and timely treatment of the thyroid disease could reduce the impact on the mother and the fetus [18,19]. It also shows that US-guided MWA is feasible for treating the AFTNs during pregnancy. Many studies have demonstrated that MWA is an alternative treatment for the elderly patients and those who cannot tolerate surgery. The outcome of this case suggests that for the pregnant women, a special group of people with higher safety requirements, MWA is a feasible and effective treatment.

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Conflict of Interest

The authors have no conflict of interest to declare.

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