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A Case of Multiple Metastases from Follicular Thyroid Carcinoma Treated with Radioactive Iodine-131 After Lobectomy

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Abstract: Follicular thyroid carcinoma (FTC) is the second most common type of differentiated thyroid cancer, with a high propensity for hematogenous metastasis, particularly to the lungs and bones. Radioactive iodine-131 (^{131}I) therapy is traditionally recommended after total thyroidectomy when minimal remnant thyroid tissue is present. However, the necessity of completion thyroidectomy before ^{131}I therapy in patients who have undergone lobectomy remains controversial. This case report describes a 73-year-old female patient with multiple distant metastases (bones, lungs, lymph nodes, and adrenal gland) that developed eight years after lobectomy for FTC. She received two courses of individualized ^{131}I therapy (70 mCi and 200 mCi) based on pre-therapeutic assessment of iodine-avidity using ^{99m}TcO4-thyroid scintigraphy. Following treatment, the patient's pain symptoms significantly improved, and follow-up whole-body iodine scintigraphy with SPECT/CT showed marked reduction in metastatic lesions with osteoblastic repair changes. Serial thyroglobulin levels demonstrated a sustained downward trend. This case suggests that for FTC patients with iodine-avid metastatic disease after lobectomy, ^{131}I therapy can be safe and effective, even in the presence of significant remnant thyroid tissue, provided that pre-treatment evaluation of iodine uptake capacity is thoroughly performed.

Keywords: Follicular thyroid carcinoma; Radioactive iodine-131 therapy; Multiple distant metastases; Remnant thyroid tissue

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1. Introduction

Follicular thyroid carcinoma (FTC) is the second most common type of differentiated thyroid cancer (DTC) after papillary thyroid carcinoma (PTC), accounting for 5%–15% of DTC cases [1,2]. The lungs and bones are the most common sites of distant metastasis. For FTC with bone metastases, radioactive iodine-131 (^{131}I) therapy can significantly alleviate pain symptoms and prolong progression-free survival [3]. However,

conventional views hold that ^{131}I therapy is primarily indicated for patients with minimal remnant tissue after total thyroidectomy. With updates in clinical practice and guidelines, this concept has gradually been revised. For DTC patients who have undergone only lobectomy and meet the indications for ^{131}I therapy, or for those who face surgical risks or refuse a second surgery, ^{131}I therapy may be a viable option. This study reports a case of a patient with multiple metastases following lobectomy for follicular thyroid carcinoma, who received individualized sequential ^{131}I therapy based on an assessment of iodine-avidity. Dynamic imaging and thyroglobulin changes were monitored, and a favorable treatment outcome was achieved. The case is reported as follows.

2. Case report

A 73-year-old female patient was hospitalized due to "one year of lumbosacral and right lower extremity pain, aggravated for four months." Four months prior to admission, the patient visited a local hospital due to worsening lumbosacral and right lower extremity pain. A chest CT revealed multiple pulmonary lesions, and a puncture biopsy indicated metastasis from follicular thyroid carcinoma. Eight years ago, the patient underwent surgical treatment at a local hospital for a "thyroid mass," with postoperative pathology indicating follicular thyroid carcinoma. No ^{131}I therapy was administered, and the patient was treated with daily regular levothyroxine sodium 50 μg. Laboratory tests upon admission: After two injections of recombinant human thyroid-stimulating hormone, serum thyroid-stimulating hormone (TSH) was 182.91 mIU/L (normal reference range: 0.566–5.91 mIU/L), thyroglobulin (Tg) > 4,920 ng/mL (1.59–50.03 ng/ml), and anti-thyroglobulin antibodies (TgAb) 0.20 mIU/L (< 4 mIU/L). Whole-body bone scintigraphy (**Figure 1**) showed multiple bone metastases. Thyroid ultrasound (**Figure 2**) indicated changes after partial thyroidectomy, with multiple lymph nodes visible in both cervical regions. 99mTcO4- thyroid scintigraphy (**Figure 3**) showed residual thyroid tissue and multiple areas of increased radiotracer uptake in the bones and both lungs. After a comprehensive evaluation, the patient underwent two courses of ^{131}I therapy on April 28, 2025, and November 18, 2025, respectively, with relevant examinations performed before and after each treatment to assess the condition. During the first 70 mCi ^{131}I therapy, the patient received intravenous methylprednisolone 40 mg/day.

On the third day, swelling and pain in the neck and right face occurred without dyspnea, considered related to radiation-induced thyroiditis. On the fifth day after treatment, whole-body iodine scintigraphy and SPECT/CT fusion imaging (**Figure 4**) showed residual thyroid tissue after thyroid surgery, multiple lymph node metastases in the right supraclavicular region, right hilum, and mediastinum, lung metastases, left adrenal metastasis, and multiple bone metastases. Fifteen days after the first ^{131}I therapy discharge, the patient's lumbosacral and right lower extremity pain significantly improved, and mobility gradually recovered, transitioning from wheelchair dependence to independent activity with full self-care ability. Before the second 200 mCi ^{131}I therapy, a repeat 99mTcO4- thyroid scintigraphy (**Figure 3**) showed a slightly increased radiotracer uptake in the right thyroid region compared to the previous scan, with disappearance of radiotracer uptake in other metastatic lesions. On the fifth day after the second treatment, repeat whole-body iodine scintigraphy and SPECT/CT fusion imaging showed a significant reduction in multiple metastatic lesions compared to before, indicating a marked improvement in the condition. The patient's thyroglobulin levels were monitored six times from before the first ^{131}I therapy to after the second treatment

(**Figure 5**), showing an overall downward trend, indicating a favorable biochemical response to treatment. After discharge, the patient's levothyroxine sodium dosage was adjusted to 100 μg daily for regular TSH suppression therapy.

Figure 1. Whole-body bone scintigraphy of a 73-year-old female patient with multiple metastases from follicular thyroid carcinoma (arrows indicate the lesions).

Multiple irregular, abnormal, radioactive foci were observed in the skull, sternum, multiple ribs, spine, pelvis, and bones of the extremities.

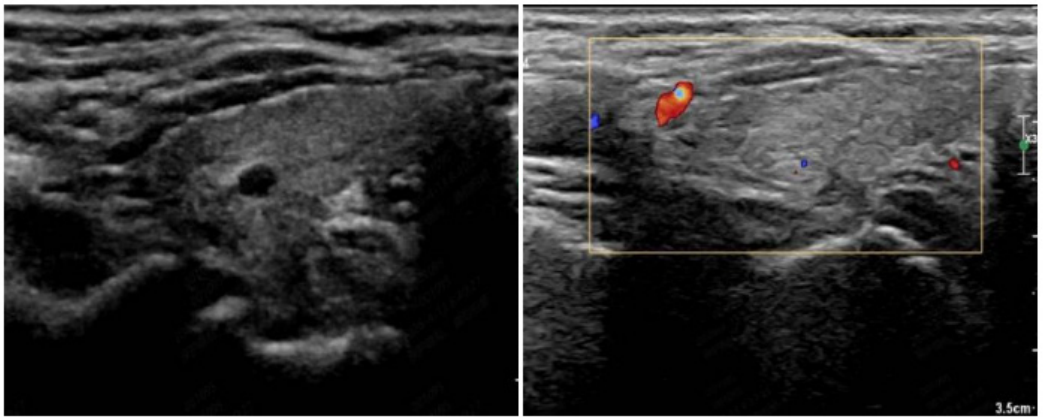

Figure 2. Thyroid color Doppler ultrasound image.

The size and shape of the right thyroid lobe are acceptable, and its surface is relatively smooth. Multiple lymph nodes with echogenicity can be detected on both sides of the neck. The larger ones are located in level II, with clear borders and relatively clear corticomedullary differentiation. CDFI (Color Doppler Flow Imaging) shows a small amount of blood flow signals within them.

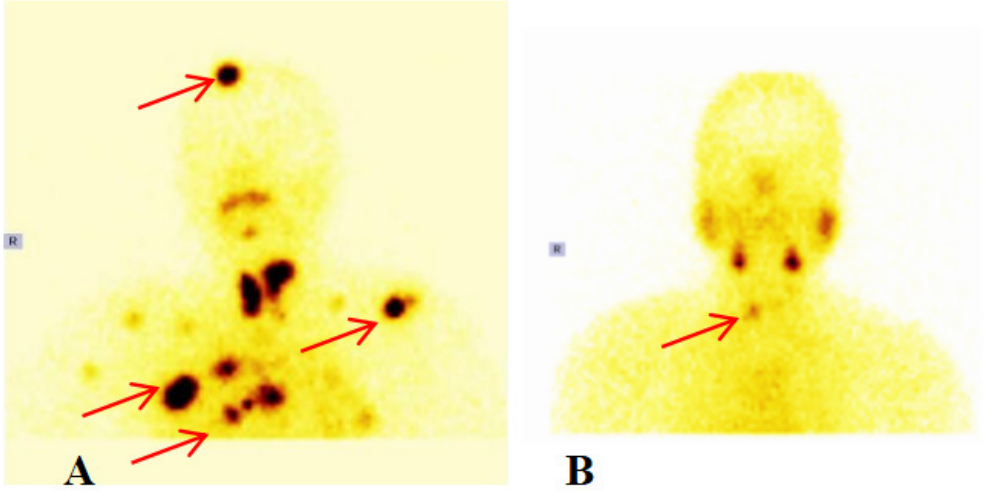

Figure 3. ^{99m}TcO4- thyroid function imaging scans before two rounds of ^{131}I therapy (lesions indicated by arrows).

Image A is the first ^{99m}TcO4- thyroid function imaging scan, showing multiple areas of increased radioactivity in the vertex of the skull, thyroid region, both shoulders, and chest. Image B is the second ^{99m}TcO4- thyroid function imaging scan, revealing a slightly hyperactive radioactive area in the right thyroid region; the parotid glands, submandibular glands, and oral cavity are also visualized.

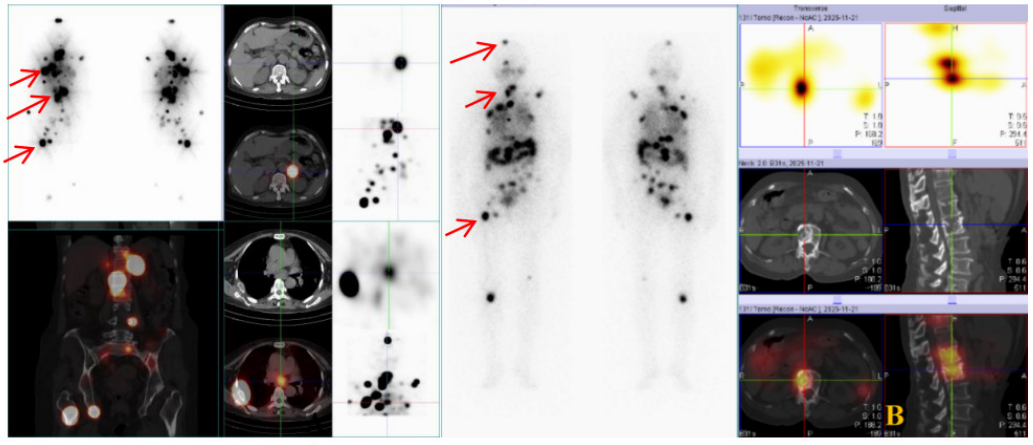

Figure 4. Whole-body iodine scintigraphy and SPECT/CT fusion images obtained on day 5 after each of the two courses of ^{131}I therapy (arrows indicate lesions).(A): Whole-body iodine scintigraphy and SPECT/CT fusion images after the first course of ^{131}I therapy. Multiple foci of increased radioactivity uptake are visible in the head, neck, thorax, abdomen, pelvis, and extremities. Multiple osteolytic destructive lesions with markedly increased radioactivity are seen in the frontal bone, spine, scapulae, ribs, pelvis, and extremity bones.(B): Whole-body iodine scintigraphy and SPECT/CT fusion images after the second course of ^{131}I therapy. Multiple foci of increased radioactivity uptake are still visible in the head, neck, thorax, abdomen, pelvis, and extremities. Compared with the previous iodine scan, the remnant thyroid tissue in the right thyroid lobe has decreased in volume and density, with reduced radioiodine uptake. The previously noted multiple bilateral pulmonary metastases, metastatic lymph nodes in the right supraclavicular region and right hilar region, as well as the adrenal metastasis, have markedly decreased in size, with no significant increase in radioactivity. The multiple osteolytic destructive lesions in the skull, spine, scapulae, ribs, pelvis, and extremity bones show predominantly osteoblastic repair changes on this scan. Some lesions show a slight size reduction, although increased radioactivity (indicating post-therapeutic repair changes) is still observed.

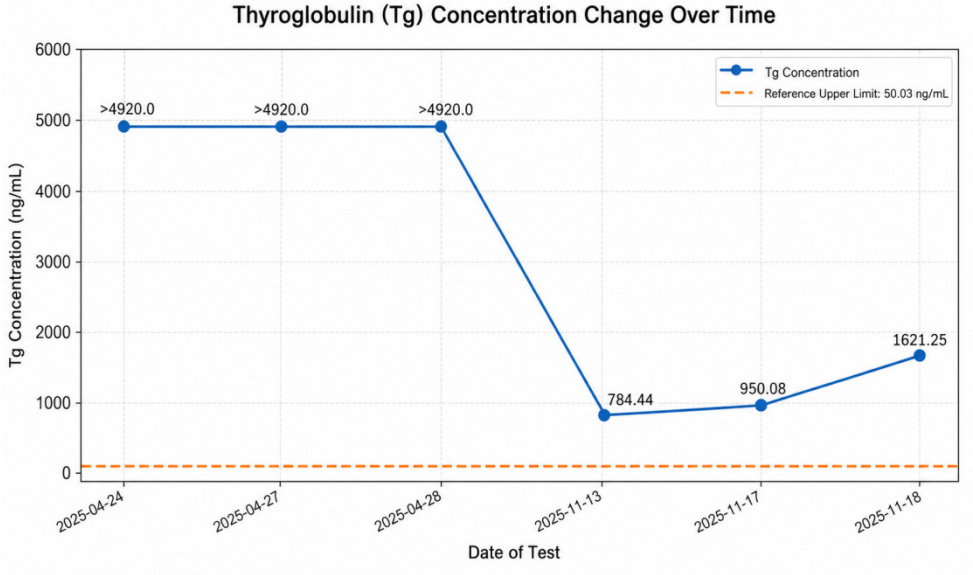

Figure 5. Graph of the changes in thyroglobulin levels.

3. Discussion

Follicular thyroid carcinoma (FTC) is the second most common type of differentiated thyroid carcinoma (DTC) after papillary thyroid carcinoma (PTC), accounting for 5–15% of DTC cases [1,2]. Unlike PTC, FTC is closely associated with vascular invasion and distant metastasis, with the lungs and bones being the most common sites of distant metastasis. For FTC patients with bone metastases, ^{131}I therapy can significantly alleviate pain symptoms and prolong progression-free survival [3].

For a long time, there has been a misconception in clinical practice that ^{131}I therapy cannot be performed after lobectomy of the thyroid gland, and that total thyroidectomy is a prerequisite for ^{131}I therapy. This concept stems from the traditional theoretical basis of ^{131}I ablation therapy, that residual thyroid tissue is minimal after total thyroidectomy, allowing ^{131}I to more effectively ablate residual tissue and treat metastases. However, this concept is being overturned by modern guidelines and clinical practice. The 2025 edition of the CSCO guidelines for the diagnosis and treatment of thyroid carcinomas of follicular epithelial origin clearly state that for DTC patients who have undergone only unilateral lobectomy and have indications for ^{131}I therapy, and where surgery poses risks or the patient refuses a second operation, ^{131}I therapy can be performed [4]. In this case, the patient developed multiple distant metastases after a lobectomy. Before the first ^{131}I therapy, a ^{99m}Tc thyroid scan showed multiple areas of intense uptake throughout the body, indicating highly active metastatic lesions. After treatment, the scan showed that the metastatic lesions had accumulated a significant amount of ^{131}I, suggesting a favorable therapeutic response. Before the second treatment, a ^{99m}Tc thyroid scan showed that the lesions did not take up the imaging agent, indicating a reduced cancer cell burden or activity within the lesions. After the second ^{131}I therapy, the scan showed a significant reduction in metastatic lesions throughout the body. This series of dynamic changes indicates that even with a significant amount of residual thyroid tissue, as long as the metastatic lesions retain iodine uptake capacity, ^{131}I therapy can still achieve favorable therapeutic outcomes. Therefore, the surgical approach is not a criterion for selecting patients for ^{131}I therapy. The decision to administer ^{131}I therapy should be based on an assessment of postoperative recurrence risk stratification and the iodine uptake capacity of the lesions.

In this case, the initial dose of ^{131}I therapy was 70 mCi, determined primarily based on pre-treatment thyroid scans and iodine uptake rate measurements. This dose adequately assessed the iodine uptake capacity of the lesions and the volume of residual tissue, ensuring treatment safety. Since the patient had undergone a lobectomy, there was a significant amount of residual thyroid tissue, and a larger dose might have caused edema in the residual tissue at the thyroid bed, compressing the trachea and leading to dyspnea and edema risks. From a therapeutic perspective, within half a month after the first ^{131}I therapy, the patient's pain symptoms were significantly alleviated. After the second treatment, the scan showed a marked reduction in metastatic lesions, indicating a favorable therapeutic response. This suggests that the dosing regimen achieved a reasonable balance between safety and efficacy. Recent studies have also confirmed that a thorough pre-treatment assessment of residual thyroid volume and iodine uptake function helps significantly reduce the incidence of complications such as radioactive thyroiditis while ensuring therapeutic efficacy [5].

4. Conclusion

The therapeutic outcomes of this case indicate that: (1) Metastatic lesions of follicular thyroid carcinoma have good iodine uptake capacity, making them ideal targets for ^{131}I therapy; (2) ^{131}I therapy after lobectomy is not only feasible but also has favorable therapeutic effects on distant metastatic lesions; (3) Accurate

pre-treatment assessment of the amount and iodine uptake capacity of residual thyroid tissue is crucial for ensuring treatment safety.

Disclosure statement

The authors declare no conflict of interest.

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