

# A case of breast metastasis from follicular thyroid carcinoma: a rare and delayed complication of thyroid cancer

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## Short Report

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# Abstract

**Background:** Follicular thyroid carcinoma (FTC) is a type of differentiated thyroid cancer that can metastasize to distant organs via hematogenous spread. Breast metastasis from FTC is an extremely rare but possible complication that can mimic primary breast cancer.

**Case Presentation:** We present a case of a 64-year-old woman who had a history of subtotal thyroidectomy for FTC 17 years ago and developed a palpable mass in her left breast. Ultrasound, mammography and fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) showed an irregular nodule with calcifications and increased FDG uptake in the left breast, as well as hypermetabolic nodules in the right lower lung and thyroid gland. The patient underwent total thyroidectomy and left segmental mastectomy, and the pathology confirmed the diagnosis of FTC recurrence and breast metastasis. The patient received three cycles of I-131 radioablation therapy and thyroid stimulating hormone (TSH) suppressive therapy, and achieved complete remission of the recurrent FTC lesion and breast metastasis.

**Conclusions:** This case highlights the importance of considering the possibility of breast metastasis from FTC in patients with a history of thyroid cancer and a suspicious breast mass. FDG PET/CT can provide valuable information for the diagnosis and staging of FTC breast metastasis. Total thyroidectomy, segmental mastectomy, I-131 radioablation therapy and TSH suppressive therapy can be an effective treatment option for this rare condition.

## Introduction

Follicular thyroid carcinoma (FTC) accounts for about 6–10% of all thyroid cancers and has a good prognosis with a 10-year survival rate of over 90% [1, 2]. However, FTC can metastasize to distant organs via hematogenous spread, especially to the lungs and bones [3]. Breast metastasis from FTC is extremely rare, with only a few cases reported in the literature [4–7]. The diagnosis of breast metastasis from FTC is challenging because it can mimic primary breast cancer in clinical presentation, imaging features and histopathology. Moreover, the treatment regimens for primary and secondary breast tumors differ, therefore an accurate diagnosis is necessary [8]. Most breast metastases are associated with poor prognosis because of their hematogenous nature [9]. Therefore, targeted and more comprehensive diagnosis, treatment and follow-up should be considered seriously. Here, we discuss the main imaging manifestations of breast metastasis using different imaging methods and share our successful treatment approaches.

## Case Report

A 64-year-old woman, who had undergone subtotal thyroidectomy for FTC 17 years ago, but whose pathology report could not be reached, presented with a 3.0 × 2.0 cm palpable mass in the left breast without any other symptoms. Ultrasound revealed an irregular hypoechoic mass on the left breast with

well-defined borders and abundant blood flow signals, which measured about  $2.6 \times 1.9 \times 2.2$  cm (shown in Fig. 1). She then underwent a diagnostic mammography. Both craniocaudal and mediolateral oblique revealed an irregular nodule with ill-defined borders, and the surrounding gland structure was distorted; in addition, calcifications were evident in the left breast. No suspicious axillary lymph nodes were found (shown in Fig. 2). She then underwent fluorodeoxyglucose (FDG) PET/CT to obtain baseline data for treatment, which revealed a hypermetabolic nodule in the upper inner quadrant of the left breast with an  $SUV_{max}$  of 7.08 and CT value of approximately 43.2 Hu (shown in Fig. 3), as well as hypermetabolic nodules in the right lower lung and thyroid gland. Considering her previous medical history of subtotal thyroidectomy, we speculated that thyroid cancer recurrence with breast and lung metastasis was the most likely diagnosis. Subsequently, the patient underwent total thyroidectomy and left segmental mastectomy. Postoperative pathology of the breast mass showed that a large number of abnormal glands were arranged like follicles. This finding was not sufficient for the diagnosis of breast metastasis from FTC. Immunohistochemistry (IHC) further confirmed the diagnosis of breast metastasis from FTC (TTF-1 (+), Pax-8 (+), TG (partially weak +), ER (-) and PR (-)). After surgical treatment, the patient received three cycles of I-131 radioablation therapy and TSH suppressive therapy. During this period, the patient underwent I-131 whole-body scan three times, all of which showed negative results in the breast area (shown in Fig. 4). She then underwent PET/CT at the 12th month after segmental mastectomy. The second PET/CT showed a  $1.0 \times 1.0$  cm mild metabolic nodule in the left breast area with  $SUV_{max}$  of 1.32 (shown in Fig. 5). After discussion in the nuclear medicine department, the lesion was finally diagnosed as a postoperative change. This indicated that complete remission (CR) was achieved for the recurrent FTC lesion and breast metastasis. We will continue to closely follow up the patient's condition for a long time.

## Discussion

The patient in this case had history of FTC thyroidectomy. Unlike primary breast carcinoma, architectural distortion, calcification, posterior acoustic shadowing, spiculated margins, and skin or nipple retraction are infrequent in breast metastatic lesions on mammography and ultrasound. The involvement of axillary lymph node is also less common in metastatic lesions than in primary breast cancer [10, 11]. However, in this case, the imaging presentation of breast metastasis was accompanied by distortion and calcification of the surrounding glands, which was not entirely consistent with conventional mammography findings. Therefore, mammography and ultrasound alone do not completely explain the secondary nature of breast malignancy.

This patient's PET/CT showed FDG signal in the thyroid region, lung, and breast lesion. Because of the patient's history of FTC thyroidectomy, the probability of a final diagnosis of FTC metastasis to the lung and breast using PET/CT is relatively high [4, 12]. PET/CT is not specific for the diagnosis of breast lesions, as it cannot be used to determine whether a breast lesion is a metastasis or a primary lesion based on  $SUV_{max}$  alone [10]. A history of thyroidectomy can render the evidence of PET/CT more reliable for the diagnosis of FTC breast metastasis. Previous studies have reported similar cases of FTC breast

metastasis confirmed by PET/CT findings and postoperative pathology [4, 5]. Therefore, a thyroid-related disease history is important for the diagnosis of FTC breast metastasis.

For the treatment of DTC, National Comprehensive Cancer Network and American Thyroid Association guidelines typically recommend total thyroidectomy, TSH suppression therapy, and I-131 radioablation for patients at high risk of recurrence. However, persistence/recurrence still occurs in 20–30% of these patients [13].

In this case, the patient was not treated with I-131 radioablation and TSH suppression after the initial subtotal thyroidectomy. Expert consensus or recommended treatment options for metastasis to the breast, a rare metastatic site, is lacking. We decided to adopt a regimen of total thyroidectomy and segmental mastectomy, followed by I-131 radioablation for this patient. This is because of several reasons: first, the prognosis of FTC is relatively worse than that of PTC [14]; second, unlike FTC, which is limited to the thyroid or cervical lymph nodes, the average 5-year overall survival rate for patients with distant metastases is generally reduced to 50% [13]; third, FDG-positive lesions on PET images usually indicate undifferentiated changes in FTC lesions, indicating relatively poor prognosis for FTC. Therefore, we believe that the efficacy of I-131 radioablation alone for the treatment of breast metastasis is not significant, and local surgical excision of recurrent foci and metastasis should be performed first. As this patient had metastasis, incomplete tumor resection or high-risk continued radioiodine therapy and TSH suppression therapy were definitely indicated. Unfortunately, I-131 whole-body imaging was not performed before mastectomy for breast metastasis in this case. Total thyroidectomy, segmental mastectomy, I-131 radioablation, and TSH suppression therapy enabled CR of the recurrent FTC foci and breast metastasis in a relatively short period of time. Thus, this case revealed a reliable treatment option for breast metastases from FTC.

The main limitation of our case report is that we did not perform I-131 whole-body imaging before mastectomy for breast metastasis, which could have provided more information on the extent and distribution of the metastatic lesions. The main implication of our case report is that it provides a valuable reference for the diagnosis and treatment of breast metastasis from FTC, which is a rare but possible complication of thyroid cancer. We report a case of FTC breast metastasis that occurred 17 years after subtotal thyroidectomy, which is an exceptionally long interval compared to previous reports [4, 6]. This suggests that long-term follow-up and surveillance are necessary for patients with FTC, especially those with incomplete tumor resection or high-risk features. Clinicians should be aware of the possibility of breast metastasis from FTC in patients with a history of thyroid cancer, especially if they present with a new breast mass or pain. Radiologists should also consider breast metastasis from FTC in the differential diagnosis of breast lesions, especially if they show discordant iodine and FDG uptake on functional imaging. A prompt diagnosis is crucial to avoid unnecessary or inappropriate interventions and to initiate adequate treatment.

## Conclusion

Breast metastasis from FTC is extremely rare and imageological examination is always not sufficiently specific for the differential diagnosis of breast metastases. The present case emphasizes the importance of the detailed thyroid-related disease history in the differential diagnosis of the FTC breast metastasis. We suggest that total thyroidectomy, segmental mastectomy, I-131 radioablation therapy and TSH suppressive therapy be the first choice for treatment of this tumor.

## **Declarations**

### **Acknowledgement**

We thank our colleagues from the Affiliated Qingdao Central Hospital of Qingdao University for the diagnosis and treatment of this case, and the patient and her family members who agreed to publication of this case.

### **Statement of Ethics**

The study has been approved by the Ethical Committee of the Affiliated Qingdao Central Hospital of Qingdao University ([Y]KY202202101). Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

### **Conflict of Interest Statement**

There are no conflicts of interest for all authors.

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### **Author Contributions**

All named authors have agreed to the submission and have participated in the study to a sufficient extent to be named as authors should accompany the submitted manuscript. Kexu Chen, manuscript writing. Xu Jiang, Guiling Wang and Minggang Yuan, data collection. Longchuan Zhuang, report design and manuscript editing. All authors read and approved the final manuscript.

### **Data Availability Statement**

The authors declare that data supporting the findings of this study are available within the paper.

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## Figures



**Figure 1**

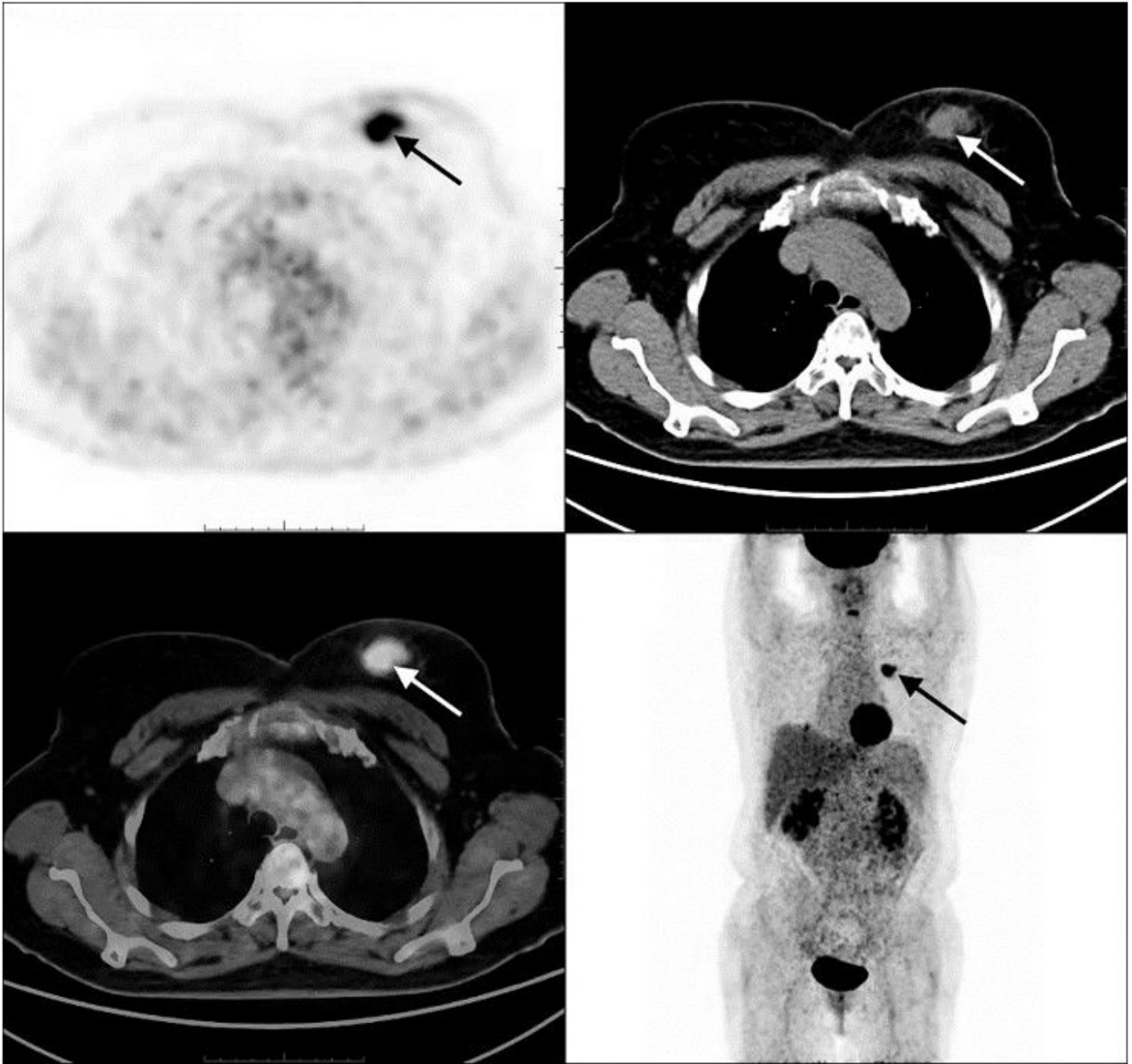
Ultrasound examination of the breast revealed an irregular hypoechoic mass on the left breast with well-defined borders and abundant blood flow signals, which measured about  $2.6 \times 1.9 \times 2.2$  cm. No suspicious axillary lymph nodes were found.



**Figure 2**

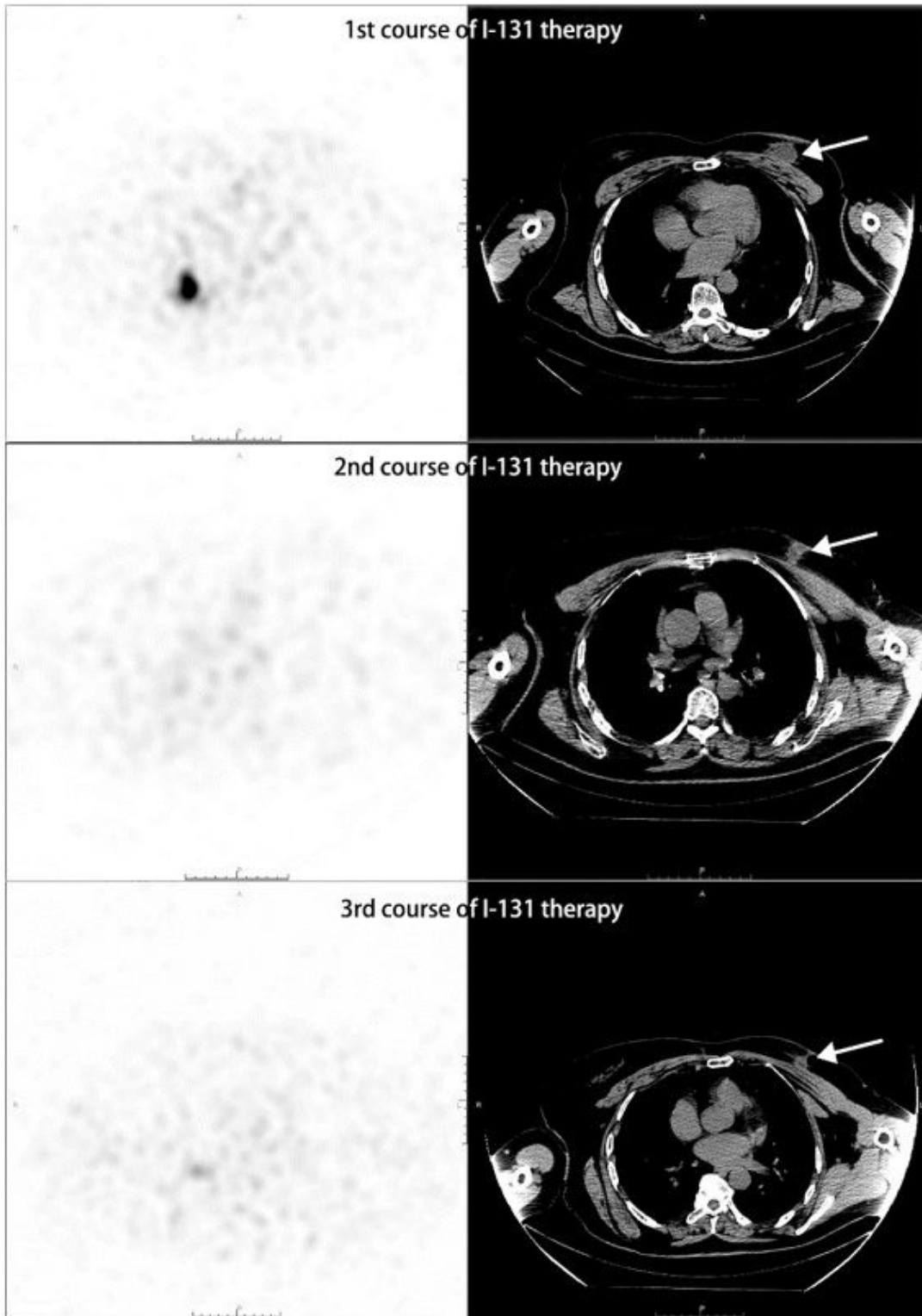
Mammography showed a high-density mass shadow in the left breast, with unclear boundary and irregular shape, measuring approximately 3.1 x 2.3 cm, with distorted surrounding glandular structures. The left breast also showed orbit-like calcification.





**Figure 3**

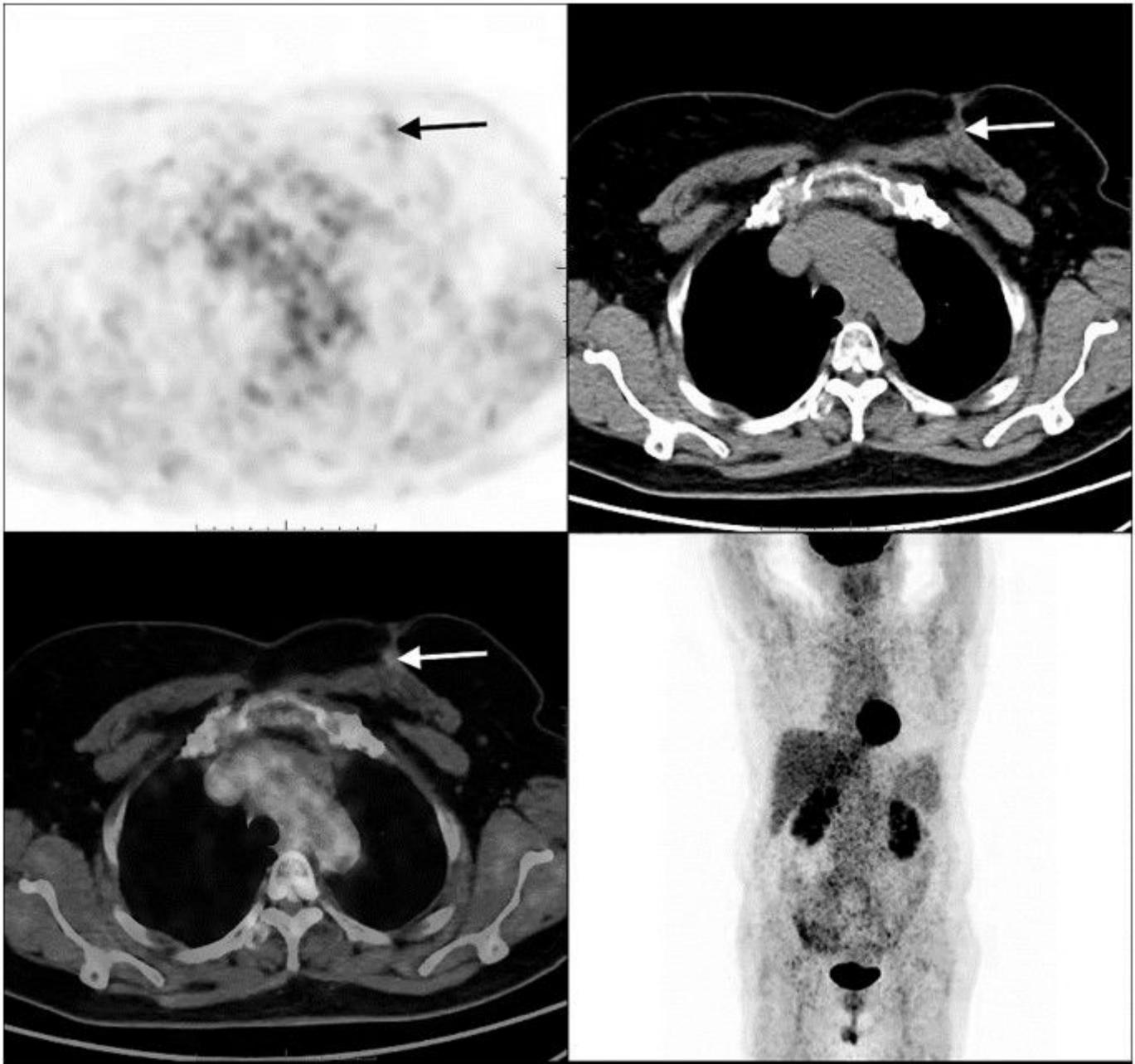
FDG PET/CT revealed a hypermetabolic nodule (2.8 × 2.0 cm) with  $SUV_{max}$  of 7.08 in the left upper internal quadrant of the breast (white arrow), as well as hypermetabolic nodules in the right lower lung and thyroid gland.



**Figure 4**

The patient underwent left partial mastectomy and total thyroidectomy followed by three courses (2, 6, and 10 months after surgery, respectively) of I-131 therapy for the metastatic FTC. The I-131 ablative doses ranged from 100 to 150 mCi. I-131 whole body scan (WBS) and single photon emission computed tomography (SPECT)/CT scan were performed five to seven days after each ablative treatment. During all three courses of ablation therapy, I-131 WBS showed negative result in the breast site, indicating the

absence of significant breast metastasis after FTC. Additional SPECT/CT scans showed that the nodular shadow of the left breast surgical area was gradually absorbed with the three courses of I-131 therapy.



**Figure 5**

FDG PET/CT showed a nodular shadow (1.0 × 1.0 cm) with only mild metabolic activity ( $SUV_{max}$  of 1.32) in the left breast.