I-131 uptake in the breast from fat necrosis

Joseph T. Hoang, BS^a , Matthew R. Weissenborn, MD^b , Joseph J. Spigel, MD^b, Brian J. Welch, MD^c , and Stanley J. Grossman, MD^b

^aDepartment of Medicine, Texas A&M College of Medicine, Dallas, Texas; ^bDepartment of Radiology, Baylor University Medical Center at Dallas, Dallas, Texas; ^cDepartment of Internal Medicine, Baylor University Medical Center at Dallas, Dallas, Texas

ABSTRACT

Radioactive iodine I-131 whole-body scintigraphy is used to monitor thyroid cancer metastases after total thyroidectomy. We present a case of a woman who was diagnosed with papillary thyroid cancer and underwent a total thyroidectomy. I-131 scintigraphy revealed abnormal accumulation of radioactive iodine in the right breast causing concern for thyroid cancer metastasis. Mammographic studies confirmed that the abnormal radiotracer accumulation was due to fat necrosis in the breast. I-131 uptake in fat necrosis is a poorly understood process that is not clearly defined in the literature. This case highlights that false-positive uptake of I-131 can mimic metastases of thyroid carcinoma.

KEYWORDS Breast; fat necrosis; I-131; thyroid cancer

Thyroid cancer is the most common endocrine cancer worldwide.^{1,2} Differentiated thyroid cancers (papillary and follicular) constitute up to 90% of all thyroid neoplasms that originate from follicular cells.³ I-131 whole-body scintigraphy is used for surveillance of metastases after total thyroidectomy. Reports of false-positive findings are from physiologic distribution or contamination of radioactive iodine. This case describes an uncommon finding of radioactive iodine uptake on I-131 scintigraphy in the breast due to fat necrosis.

CASE DESCRIPTION

A 27-year-old woman presented with a palpable mass on the right side of the neck. Ultrasound revealed a 3.6-cm nodule in the right thyroid lobe. Fine needle aspiration demonstrated papillary thyroid carcinoma. She had a total thyroidectomy, and pathological examination confirmed papillary thyroid carcinoma measuring <1 cm with extra-thyroidal invasion and no lymph node metastases. She was treated with 158 mCi of I-131 radioactive iodide ablation 1 month after surgery. Whole-body scintigraphy 7 days after therapy showed no uptake in the neck, but abnormal radiotracer accumulation was seen within the anterior aspect of the inferior right chest (*Figure 1a*). A follow-up single-

photon emission computed tomography (CT) scan localized the uptake to a 1.6-cm nodular density in the medial right breast (*Figures 2a, 2b*). An unusual thyroid cancer metastasis was the major concern. Follow-up mammography demonstrated two contiguous fat-containing low-density masses in the right medial and subareolar breast (*Figure 2c*). Ultrasonography demonstrated mixed echogenicity, predominantly a hyperechoic rimmed 1.2-cm mass with an adjacent subtle mass in the subareolar breast. The combination of findings was favored to represent evolving fat necrosis. One year later, whole-body scintigraphy demonstrated resolution of the I-131 avid lesion in the right breast (*Figure 1b*). The patient's serum thyroglobulin levels have been undetectable over the past 3 years on follow-up visits.

DISCUSSION

The incidence of thyroid cancer increased by 211% between 1975 and 2013.⁴ This may be due to better means of detection with I-123 scintigraphy and thyroid ultrasound. An estimated 53,990 new cases will be diagnosed this year in the United States, with about three out of four cases affecting women.⁵ Treatment and surveillance of thyroid cancer regularly involve the use of radioiodine isotope I-131. Whole-body scintigraphy detects uptake of I-131, allowing the

Corresponding author: Stanley J. Grossman, MD, Department of Radiology, Baylor University Medical Center at Dallas, 3500 Gaston Avenue, Dallas, TX 75246 (e-mail: stanley.grossman@bswhealth.org)

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Figure 1. (a) Anterior and posterior planar images from the posttreatment I-131 whole-body scintigraphy show a focus of abnormal tracer localization in the region of the right anterior chest (white arrow). (b) Whole-body scintigraphy 1 year later shows resolution of previous I-131 accumulation in the right anterior chest.

Figure 2. (a) Fused image utilizing axial CT and axial single-photon emission CT images localizes the focus of tracer accumulation to the right breast (solid white arrow). (b) Contrast-enhanced CT image shows two contiguous small soft tissue densities in the right breast (open white arrowhead). (c) Mammographic compression imaging in right mediolateral oblique view reveals two masses of low density in the right medial and subareolar breast containing areas of fat.

visualization and assessment of metastatic or recurrent thyroid carcinoma throughout the body. I-131 uptake into cells depends on the presence of a sodium-iodide symporter, but the full mechanism remains unclear.

Physiologic uptake of I-131 can be seen in tissues outside of the thyroid, including the thymus, salivary glands, lacrimal glands, gastrointestinal tract, liver, and breast.⁶ Radioiodine contamination can be detected in physiologic secretions such as saliva, urine, sweat, feces, and breast milk, causing artifacts unrelated to sodium-iodide symporter function.^{6,7} Inflammatory processes can cause false-positive radioiodine uptake through vasodilation and capillary

permeability. Examples of this include hematomas, sinusitis, respiratory infections, myocardial infarction, and cholecystitis.^{6,7} False-positive uptake in the chest region can also be due to thoracic aortic aneurysms or esophageal abnormalities.⁶ Single-photon emission CT can determine whether uptake is intrathoracic or extrathoracic and further localize the lesion to a specific organ or tissue.

Breast uptake of radioiodine is a normal finding in lactating postpartum women due to the increased expression of sodium-iodide symporter in mammary glands to provide sufficient iodine to nursing infants in breast milk.⁸ One study reported that radioiodine uptake occurs in at least 6%

of nonbreastfeeding hypothyroid females.⁹ Differential diagnosis of diffuse uptake of radioiodine includes hyperprolactinemia or breast lactation, and focal uptake includes benign cyst, metastatic thyroid cancer, benign tumor, or primary breast malignancy.

Fat necrosis of the breast is a benign inflammatory process that is commonly caused by trauma, breast surgery, radiation therapy, or diagnostic breast interventions.¹⁰ Fat necrosis appears as an area of hemorrhage in fat that is surrounded by lipid-laden macrophages, histiocytes, and multinucleated giant cells. Fibrosis and calcification from fibroblasts appear in later stages.^{11,12} The mechanism of radioiodine uptake in fat necrosis of the breast is poorly understood. Only one previous case of I-131 uptake in the breast from fat necrosis has been reported in the literature.¹³ The differential for iodine uptake in the chest includes pathologic and inflammatory processes in the lungs, mediastinum, chest wall, and breast. Additional imaging can help determine the true location and etiology for I-131 uptake in the chest.

ORCID

Joseph T. Hoang <http://orcid.org/0000-0002-2223-3150>

Matthew R. Weissenborn <http://orcid.org/0000-0003-4878-1187>

Brian J. Welch <http://orcid.org/0000-0003-2550-5454>

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