

CASE REPORT

Unusual iodine-131 postablation whole-body scintigraphy patterns in patients after robot-assisted/endoscopic thyroidectomy: Case series

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Abstract

Robot-assisted/endoscopic thyroidectomy causes irritation due to instruments or implantation of thyroid tissue on the anterior chest wall and lower neck. We present three patients who exhibited unexpected focal lesions on postablation Iodine-131 single-photon emission computed tomography/computed tomography without biochemical and structural diseases. Meticulous surgical techniques are important to prevent complications.

KEY WORDS

endoscopic thyroidectomy, Iodine-131 whole-body scintigraphy (WBS), positron emission tomography/computed tomography (PET/CT), robot-assisted thyroidectomy, single-photon emission computed tomography/computed tomography (SPECT/CT), thyroid carcinoma, unusual patterns

1 | INTRODUCTION

Robot-assisted/endoscopic thyroidectomy has recently advanced with the development of various surgical techniques and instruments. Robot-assisted/endoscopic thyroidectomy using axillary, anterior chest, breast, or postauricular approaches is performed to minimize surgical morbidity and visible neck scarring.¹⁻³ Robot-assisted/endoscopic thyroidectomy requires creation of a working space, which is unnecessary for transcervical open thyroidectomy. After thyroidectomy, the patients are followed up and monitored for response and recurrence using modalities, such as blood examination for thyroglobulin (Tg) and Tg antibody (Tg-Ab) levels, ultrasonography (US), and iodine-131 (I-131) whole-body scintigraphy (WBS) after radioiodine therapy. These assessments for recurrence or metastasis detection and for differential diagnosis are performed using US-guided fine needle aspiration (FNA), single-photon emission computed tomography/computed tomography (SPECT/CT), and

positron emission tomography/CT (PET/CT). Advances in surgical techniques may lead to unusual imaging findings that would not be observed after conventional thyroidectomy. Unexpected findings should be carefully interpreted by considering whether they could reflect lesions are iatrogenic so that misinterpretation or unnecessary treatment is avoided. Herein, we report the cases of three patients who underwent robot-assisted/endoscopic thyroidectomy and presented with unusual findings on WBS and SPECT/CT in the lower neck and anterior chest wall.

2 | CASE PRESENTATION

2.1 | Case 1

A 54-year-old woman diagnosed with a Hürthle cell neoplasm using FNA underwent endoscopic left lobectomy performed through a bilateral breast and modified left axillary

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approach. As frozen biopsy indicated a follicular carcinoma, the procedure was modified to include total thyroidectomy with left central lymph node dissection. Pathology confirmed a 1.7-cm Hürthle cell carcinoma with capsular invasion. Two additional and unexpected small papillary thyroid carcinoma nodules were also diagnosed in the same lobe. Four months later, 481-MBq radioiodine therapy was performed after levothyroxine (LT4) withdrawal. The serum thyroid-stimulating hormone (TSH), Tg, and Tg-Ab levels were 62.58 $\mu\text{IU/mL}$ (normal range 0.3-5.0 $\mu\text{IU/mL}$), 0.22 ng/mL (0.90-1.80 ng/dL), and 14.72 U/mL (~ 60 U/mL), respectively. Postradioiodine therapy WBS and SPECT/CT showed remnant thyroid tissue with another area of focal uptake around the left sternoclavicular junction was detected (Figure 1A-C). The neck US and PET/CT did not show abnormal findings in the corresponding area (Figure 1D). The unusual uptake disappeared 6 months later on I-123 WBS, and Tg was low at <0.15 ng/mL. There was no definite evidence of operative bed recurrence 6 years after radioiodine therapy.

2.2 | Case 2

A 36-year-old woman underwent robot-assisted total thyroidectomy with left central neck lymph node dissection due to papillary thyroid carcinoma. Surgery was performed using a bilateral axillo-breast approach, and TNM staging was pT1N0M0. She was treated with 370-MBq radioiodine therapy using a recombinant human TSH. The serum TSH, stimulated Tg, and serum Tg-Ab levels were 88.56 $\mu\text{IU/mL}$ (0.3-5.0 $\mu\text{IU/mL}$), <0.15 ng/mL (0.90-1.80 ng/dL), and 25.72 U/mL (~ 60 U/mL), respectively. Similar to case 1, postradioiodine therapy WBS and SPECT/CT obtained 6 months later showed an area of unusual focal uptake near the sternal end of the left clavicle with remnant thyroid tissue (Figure 2A-C). No abnormal uptake was seen in the corresponding area on PET/CT images (Figure 2D). Ten months later, no residual uptake was seen in the corresponding area in the left lower neck on I-123 WBS, and the patient tested negative for serum Tg after LT4 withdrawal. There was no evidence of tumor recurrence after a follow-up period of 6 years.

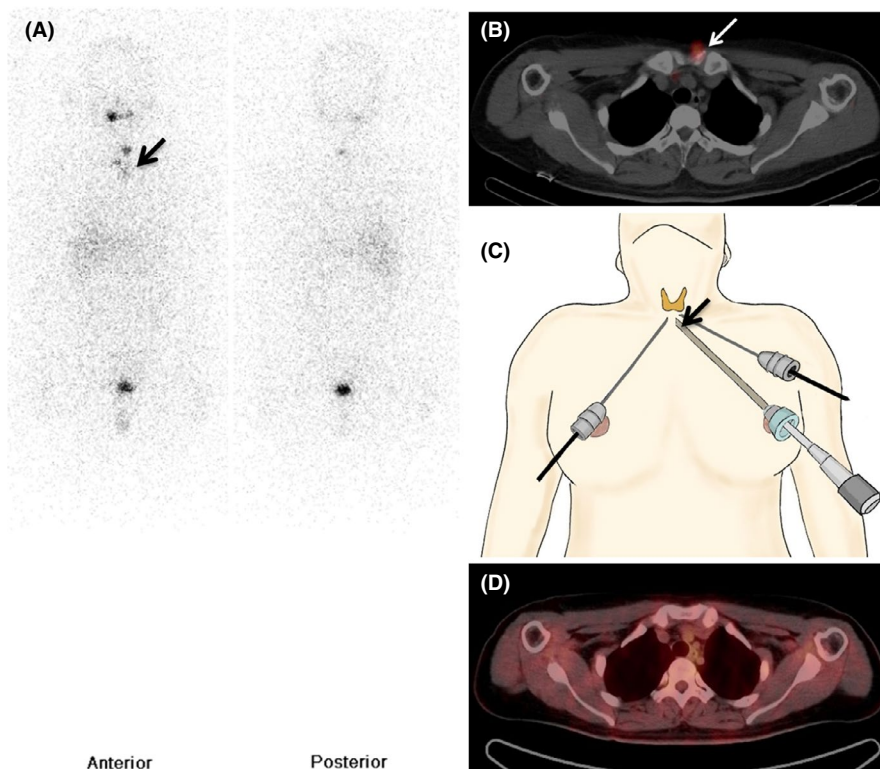


FIGURE 1 A 54-y-old woman with Hürthle cell carcinoma underwent endoscopic total thyroidectomy with left central lymph node dissection through a bilateral breast and modified left axillary approach. A, Remnant thyroid tissue with another area of focal uptake around the left lower neck (black arrow) noted on whole-body scintigraphy (WBS) after 481-MBq radioiodine therapy. Several physiologic foci are seen in the nasal cavity, oral cavity, liver, bladder along with urine contamination, and remnant thyroid tissue. B, Single-photon emission computed tomography/computed tomography (SPECT-CT) images demonstrate this uptake around the left sternoclavicular junction (white arrow). C, Skin incisions were performed around the areola and medial to the left anterior axillary fold in this patient. The lesion in question (black arrow) was potentially caused by irritation due to surgical instruments that were all directed to the midline of the sternal notch as well shown on this illustration. D, No abnormal uptake seen in the corresponding area on positron emission tomography/computed tomography (PET-CT) images

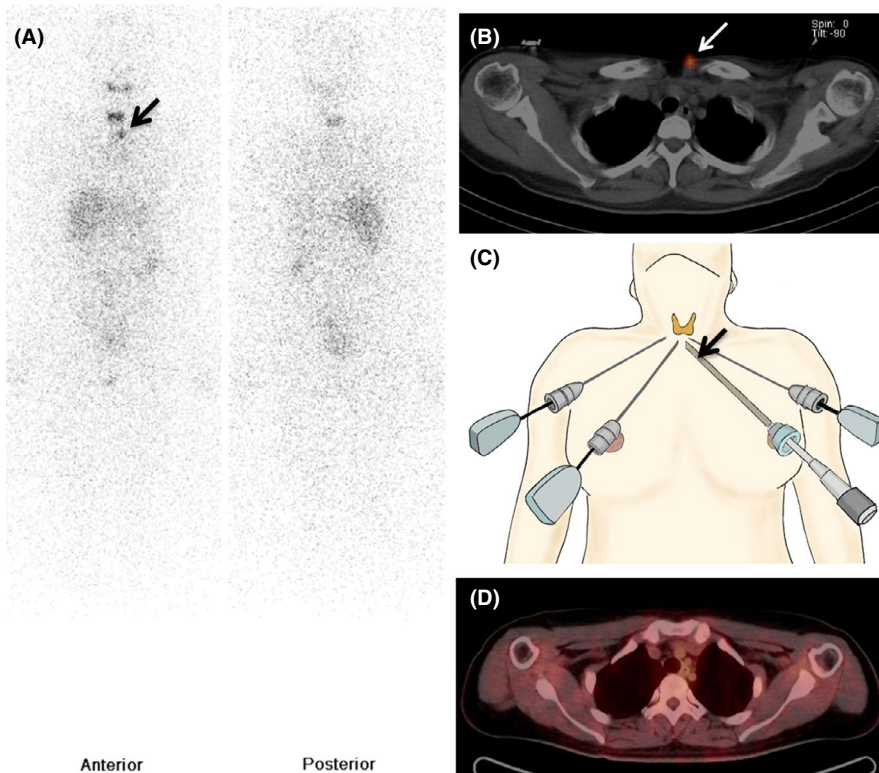


FIGURE 2 A 36-y-old woman with papillary thyroid carcinoma underwent robot-assisted total thyroidectomy with left central neck lymph node dissection. She was treated with 370-MBq radioiodine therapy. A, Postradioiodine therapy whole-body scintigraphy (WBS) shows unusual uptake near the left lower neck (black arrow) with remnant thyroid tissue. Several physiologic foci are seen in the oral cavity, liver, bowel, bladder, and remnant thyroid tissue. B, Single-photon emission computed tomography/computed tomography (SPECT-CT) images show uptake around the left sternoclavicular junction (white arrow). C, The lesion indicated by the arrow in this illustration is the affected area caused by the bilateral axillo-breast surgical approach, which was compatible with the uptake observed in Figure 2A and B. D, No area of abnormal uptake in the corresponding region as seen on positron emission tomography/computed tomography (PET-CT) images

2.3 | Case 3

A 42-year-old woman with multiple papillary thyroid carcinomas underwent total thyroidectomy using a robot-assisted bilateral axillo-breast approach. The largest tumor (0.4 cm) was on the left lobe with extrathyroidal extension. There was no definite evidence of lymph node metastasis. Radioiodine therapy of 592-MBq was administered 3 months later, and focal area of subcutaneous uptake in the upper central area of the right breast was observed with remnant thyroid tissue on postradioiodine therapy WBS and SPECT/CT (Figure 3A-C). Serum TSH, stimulated Tg, and serum Tg-Ab levels were >100 $\mu\text{IU/mL}$ (0.3-5.0 $\mu\text{IU/mL}$), 0.8 ng/mL (0.90-1.80 ng/dL), and 47.83 U/mL (~ 60 U/mL), respectively. PET/CT showed no abnormal uptake involving the right breast (Figure 3D), and breast US also showed no abnormal finding in the corresponding area. Follow-up I-123 WBS was negative, and stimulated Tg using thyroid hormone withdrawal was undetectable. No abnormal findings were observed in the corresponding area after a follow-up period >7 years.

3 | DISCUSSION

Although robot-assisted/endoscopic thyroidectomy had advantages of excellent aesthetic outcomes and fast recovery, there were several disadvantages, such as highly selective indications, extensive dissection to create a working space, narrower operative space, and relatively longer operation times.⁴ During robot-assisted/endoscopic thyroidectomy, the anterior chest wall and lower neck are irritated and pressured by surgical instruments through the axillary, breast, and chest wall approaches. In our patients, the lesions showing unusual uptake on WBS were those that developed as a complication of the surgical procedure.

In cases 1 and 2, unusual uptake areas were visualized in the subcutaneous or subplatysmal layer over the left clavicle sternal end. Although the unlikely possibility of thyroid tissue or tumor microseeding cannot be conclusively excluded, the unusual uptake observed in both cases could be considered to reflect postoperative changes because stimulated Tg was undetectable at the time of postradioiodine therapy WBS and the rigid instruments used during the procedure may have repeatedly pressured the areas located adjacent to the

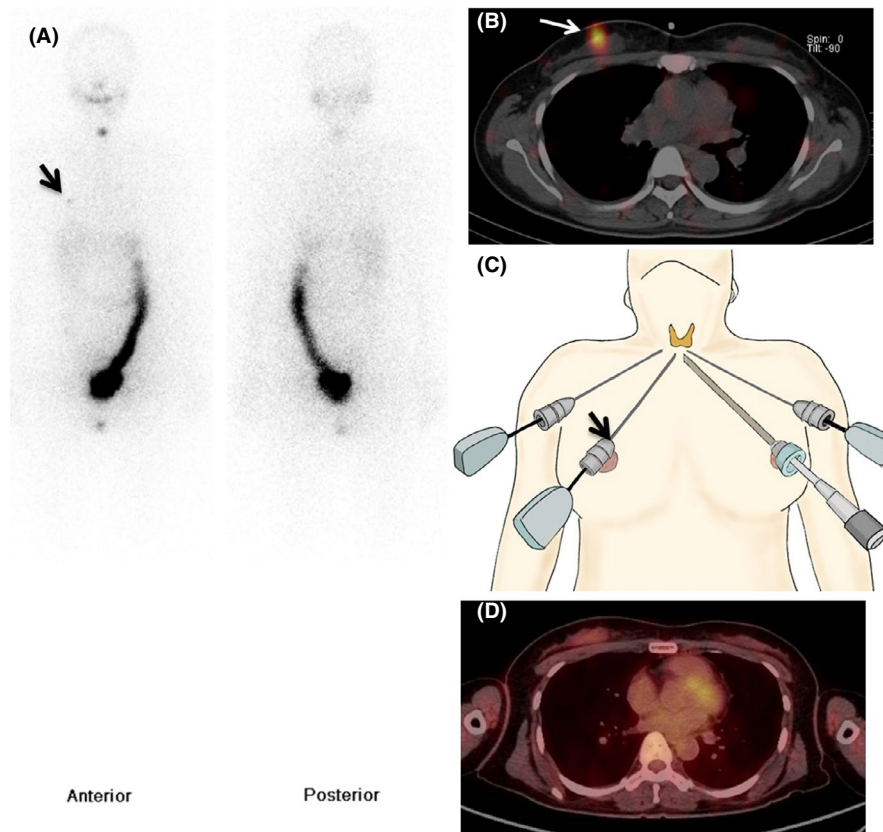


FIGURE 3 A 42-y-old woman with multiple papillary thyroid carcinomas underwent robot-assisted total thyroidectomy. A and B, Postradioiodine therapy whole-body scintigraphy (WBS) and single-photon emission computed tomography/computed tomography (SPECT-CT) performed after the patient received 592-MBq radioiodine therapy. Focal areas of subcutaneous uptake are seen in the upper center area of the right breast including the residual thyroid tissue (black and white arrows). Several physiologic foci are seen in the nasal cavity, oral cavity, salivary gland, liver, bowel with feces, bladder, and remnant thyroid tissue on postradioiodine therapy WBS. C, The lesion in this illustration is potentially related to the physical stress caused by subcutaneous tunneling from the circumareolar area to the suprasternal notch where blunt dissection was performed to create a working space for thyroidectomy (black arrow). D, No abnormal uptake in the corresponding area on positron emission tomography/computed tomography (PET-CT) images

underlying bone, thus causing inflammation and irritation. Indeed, there are two documented cases of patients with post-operative inflammation owing to tunnels in sites similar to those observed in our patients.⁴

The anterior chest wall is vulnerable to injury during tunneling while using the bilateral axillo-breast approach.⁵ In case 3, the thyroidectomy specimen was retrieved using an endoplastic bag through the left axillary port. Both upper circumareolar and axillary area incisions were made, and the subcutaneous spaces were dissected using a vascular tunneler for working space creation. Considering the unremarkable laboratory and imaging study results, the lesion where uptake was observed on WBS and SPECT/CT possibly reflects irritation or physical stress to the fragile subcutaneous and/or adjacent mammary tissue.

Unusual findings on WBS have been observed on various physiologic and pathologic occasions.⁶ Inflammation is a common causative factor of false-positive results on WBS. In a broad sense, inflammation may include infection,

trauma such as local irritation, autoimmunity, or ischemia. The mechanism of accumulation of I-131 at these sites is related to hyperemia, vasodilatation, and increased capillary permeability, which are related to complex interactions of the inflammatory cells, lymphokines, and immune mediators. SPECT/CT provides good quality diagnostic images by combining CT and WBS and thereby plays an important role in management decisions.⁷ Our patients showed no abnormal findings on US and PET/CT in the corresponding areas observed on WBS and SPECT/CT; thus, biopsy was not applicable. No recurrence or metastasis was observed during the long follow-up period. Based on the concordance of various parameters and surgical procedures, we concluded that the unusual uptake areas were related to physical stress or irritation rather than to recurrence or metastasis. Although tumor microseeding and microimplantation of the thyroid tissue along the port site cannot be completely excluded based on the normal laboratory and imaging findings, even in such occasions, radioiodine therapy is useful for lesion ablation,

and the originally observed abnormal uptake areas had disappeared on the follow-up I-123 WBS.

4 | CONCLUSIONS

The development of various surgical techniques could lead to unexpected imaging findings after operation and follow-up. With the development of hybrid technology, the unusual results observed on planar imaging can be embodied in anatomical locations through combination with CT. Differential diagnosis of unexpected abnormal findings on WBS must be established through systematic radiologic evaluations; this will aid in preventing misinterpretation of the findings and administration of unnecessary treatment. It is suggested that meticulous surgical techniques and accumulated experience are important to prevent complications, as these abnormal findings may be due to the surgical procedure itself.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

HS and MRK: made major contributions to the writing of this manuscript. All authors read and approved the final manuscript.

ETHICAL APPROVAL

The study was conducted in compliance with the Institutional Review Board (IRB) regulations (HPIRB 2016-10-016) and

the Declaration of Helsinki. The IRB approved a request to waive the need for informed consent.

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