Renal Metastasis from Follicular Thyroid Carcinoma Diagnosed by I-131 Whole-body Scan Mimicking Renal Cell Carcinoma on Contrast-Enhanced Computed Tomography

Miju Cheon · Joon Young Choi · Hee Kyung Kim ·
Jae-Hoon Chung · Young Hyeh Ko · Young Eun Kim ·
Dongil Choi · Kyung-Han Lee · Byung-Tae Kim

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Abstract Clinically detectable well-differentiated metastatic thyroid carcinoma to the kidney is rare and should be differentiated from primary renal malignancy. We report a case of renal metastases from follicular thyroid carcinoma (FTC) diagnosed by I-131 whole body scan. Additional features of this case different from previous case reports are solitary renal metastasis on I-131 whole body scan and mimicry of renal cell carcinoma on contrast-enhanced computed tomography.

Keywords Follicular thyroid carcinoma · Renal metastasis · Renal cell carcinoma · I-131 whole body scan

Introduction

Although secondary tumors involving the kidneys are not uncommon, it is rare to find metastatic renal cancer from differentiated thyroid carcinoma (DTC). It is important to differentiate between renal cell carcinoma (RCC) and renal metastases in order to determine indications for surgery. Due to its high specificity, I-131 whole body scans (WBS) are suggested to diagnose renal metastasis from DTC [1–5]. There are 20 case reports about renal metastasis from DTC in the literature. Among them, only five case reports presented renal metastasis from DTC demonstrated by I-131 WBS (Table 1) [1–5]. All had multiple functioning metastases on I-131 WBS. Contrast-enhanced computed tomography (CECT) was performed in the three of five studies where CT findings did not show typical findings of RCC [2–4]. Herein, we report a case of follicular thyroid carcinoma (FTC) metastasized to the kidney only, diagnosed by I-131 WBS mimicking RCC on CECT.

Case report

A 76-year-old woman with known well-differentiated FTC was seen in October 2007 because of a palpable neck mass. Over a 1-year follow-up period, she had I-131 therapy three times: once for ablation therapy (1.1 GBq of I-131) and twice for empiric therapy (3.7 GBq of I-131) due to elevated serum thyroglobulin (TG) levels, a sensitive marker for recurrent DTC. Her TG level without thyroxine treatment was 3,238 ng/ml at the time of first iodine ablation therapy, whereas at the time of the second and third empiric iodine therapies they were 10,357 ng/ml and 2,982 ng/ml with negative TG antibody findings. In

M. Cheon · J. Y. Choi (✉) · K.-H. Lee · B.-T. Kim
Department of Nuclear Medicine, Samsung Medical Center,
Sungkyunkwan University School of Medicine,
50 Irwon-dong, Gangnam-gu,
135-710, Seoul, Korea
e-mail: jynm.choi@samsung.com

H. K. Kim · J.-H. Chung
Department of Medicine, Samsung Medical Center,
Sungkyunkwan University School of Medicine,
Seoul 135-710, Korea

Y. H. Ko · Y. E. Kim
Department of Pathology, Samsung Medical Center,
Sungkyunkwan University School of Medicine,
Seoul 135-710, Korea

D. Choi
Department of Radiology, Samsung Medical Center,
Sungkyunkwan University School of Medicine,
Seoul 135-710, Korea

Table 1 Summary of the literature dealing with I-131 WBS to diagnose renal metastasis from differentiated thyroid carcinoma

No.	Sex	Age	Histology	Presentation	Interval from onset (years)	Location of renal metastases	Other metastatic sites
1	50	F	FTC	Lower back pain	0	Unilateral	Bone
2	61	F	PTC	Upper back mass	0	Unilateral	Bone
3	66	F	FTC	Lower back pain	0	Unilateral	Bone, adrenal gland
4	64	F	FTC	Increase in serum thyroglobulin	20	Unilateral	Bone
5	29	M	PTC	None	16	Unilateral	Muscle

FTC follicular thyroid carcinoma, PTC papillary thyroid carcinoma

instances with suppressed serum TSH (<0.07 uIU/ml), her TG levels were 5,655 ng/ml, 1,304 ng/ml, and 693 ng/ml in chronological order.

The first post-therapy WBS acquired 48 h after administration of 1.1 GBq I-131 showed focal uptake in the thyroid bed area (Fig. 1). In addition, focal uptake on the right quadrant abdomen, more evident in the posterior view, was found, which was considered as physiological uptake in the duodenum because of its location and size at that time (Fig. 1, arrow). The third post-therapy WBS acquired 48 h after administration of 3.7 GBq I-131 showed no abnormal uptake in the thyroid bed area. However, the focal

uptake on the right quadrant abdomen was persistent and became more intense compared with the previous scan, which suggested a metastasis to the right kidney rather than physiological uptake in the duodenum (Fig. 2).

After I-131 WBS, the abdominal CECT scan showed a 3-cm, well-enhancing, well-defined tumor in the right kidney, which was similar to RCC (Fig. 3). The patient was admitted with a presumed diagnosis of renal cell carcinoma. For the diagnosis and therapy, right radical nephrectomy was performed. Histological evaluation of the renal mass showed findings consistent with a diagnosis of metastatic FTC (Fig. 4).

Fig. 1 Anterior (a) and posterior (b) whole-body images after first I-131 ablation therapy showed a thyroidal remnant uptake. In addition, focal uptake on the right quadrant abdomen, more evident in the posterior view, was found, which was considered as physiological uptake in the duodenum because of its location and size at that time (arrow)

Fig. 2 Anterior (a) and posterior (b) whole-body images after third I-131 therapy showed a persistent focal uptake on posterior right quadrant abdomen and became more intense compared with the previous scan (arrow). This suggested metastatic FTC in the right kidney rather than physiological uptake in the duodenum

Fig. 3 Abdominal contrast-enhanced CT showed a solitary, unilateral, well-enhancing tumor in the right kidney, which mimicked primary renal cell carcinoma

Fig. 4 Histological section of the right renal mass confirmed metastatic follicular thyroid carcinoma with tumor with follicle formation (**a**, H&E, $\times 200$) surrounded by a fibrous capsule (**b**, H&E, $\times 100$)

Two months after nephrectomy, a fourth I-131 therapy (7.4 GBq) was performed; the post-treatment TG level was 34.5 ng/ml without thyroxine treatment.

Discussion

According to the literature, 1.4% to 6% of patients with DTC experienced distant metastasis [6]. The most common sites of metastasis were bone (43%), lung (40%), and mediastinum (32%). Metastases to the kidney have been reported at autopsy in 5.9% to 7.1% of patients with DTC [7]. In contrast, detection of thyroid metastases to the kidney during life is rare and, to our knowledge, has been reported in 20 cases. Of the 20 cases of renal metastasis associated with DTC, 9 were from papillary carcinoma (6 were follicular-variant papillary carcinomas) and 11 were from follicular carcinoma.

In general, metastatic renal tumors are multiple, bilateral, and accompanied by metastatic disease elsewhere, and 75% of patients with renal metastases had no symptoms [8, 9].

There are several imaging modalities to evaluate renal metastases from DTC. CT has higher sensitivity and accuracy than US in the detection of renal metastases. Honda et al. reported that CT analysis of metastatic renal metastases were characterized as small, multiple, bilateral, wedge-shaped, less exophytic, and located within the renal capsule [8]. Malignant renal masses are usually iso-intense relative to surrounding tissue on enhanced T1-weighted images of magnetic resonance imaging (MRI) [10]. There is no correlation between signal intensity and specific tissue type [11]. Therefore, MRI cannot differentiate the metastatic tumor from other solid tumors of the kidney. On the contrary, I-131 WBS can diagnose renal metastasis from DTC with high specificity [1–5]. Our result also supports previous studies. The tumoral expression level of sodium iodide symporter might have a role in the radionuclide uptake on renal metastasis like other metastatic sites [1, 12].

In our case, there were certain different features from previous reports. Firstly, the renal metastasis in this case was solitary, unilateral, exophytic, and highly enhanced on CT. This is different from previous studies, where CECT showed a low to moderately enhanced lesion [2–4]. Therefore, the possibility of RCC was not high in previous case reports. Second, there were no other sites of secondary tumor apart from the kidney. On the contrary, I-131 WBS demonstrated other distant metastasis in all previous studies. Therefore, these may raise the possibility of primary RCC rather than metastatic FTC in our case. However, intense I-131 uptake on that mass along with change in uptake compared with previous WBS highly suggested renal metastases from FTC. This is clinically important, because the best therapy for metastatic DTC

includes surgical resection of the thyroid gland, removal of as much of the metastatic focus as possible, and I-131 radionuclide therapy.

In summary, we report a patient with solitary renal metastases from FTC diagnosed by I-131 WBS mimicking RCC on CECT for the first time. We suggest our case supports the high specificity of I-131 WBS on renal metastasis from DTC, irrespective of CECT findings.

Conflict of interest statement All contributors declare no conflicts of interest, real or perceived, financial or nonfinancial supports and other relationships.

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