

A false-positive I-131 finding of duodenum diverticulum in thyroid cancer evaluation by SPECT/CT

A case report

Rang Wang, MD, Ke Zhou, MD, Qiuping Fan, MD, Haotian Chen, MD, Chengzhong Fan, MD*

Abstract

Rationale: Iodine-131 (I-131) is a sensitive marker for the detection of differentiated thyroid cancer (DTC). I-131 whole-body scintigraphy (WBS) has been used widely in evaluation of DTC patient. However, I-131 WBS exists many false-positive uptake of I-131 because radioiodine uptake can also be seen in healthy tissue or in a variety of benign and malignant non-thyroidal tumors.

Patient concerns: A 44-year-old woman with a papillary thyroid carcinoma for the purpose of ablation therapy after a total thyroidectomy. I-131 WBS showed intensive uptake by thyroid remnant. Meanwhile, a focus of increased activity was seen in right upper abdomen.

Diagnoses, interventions and outcomes: Based on an I-131 single-photon emission computed tomography/computed tomography (SPECT/CT) fusion imaging combining a Tc-99m pertechnetate dynamic SPECT scan and SPECT/CT fusion imaging with oral administration of iodine contrast agent, a descending duodenum diverticulum was diagnosed. This patient was then treated with conservative treatment, such as diet regulation, rest, appropriate use of antacids and antispasmodic agents, etc. So far, she recovered uneventfully with no any complications.

Lessons: Duodenum diverticulum is a rare false-positive uptake of I-131, it might be a diagnostic challenge when there are many false-positive uptake of I-131 in evaluation of DTC. So it must be significant to be familiar with these physiologic and pathologic variants of I-131 uptake and make further efforts to accurately interpret radioiodine scintigraphy results.

Abbreviations: CT = computed tomography, DTC = differentiated thyroid cancer, FTC = follicular thyroid carcinoma, I-131 = iodine-131, NIS: sodium-iodide symporter, PTC = papillary thyroid carcinoma, SPECT/CT = single-photon emission computed tomography/computed tomography, WBS = whole-body scintigraphy.

Keywords: differentiated thyroid carcinoma, duodenum diverticulum, I-131, SPECT/CT, whole-body scan

1. Introduction

As a curable malignant tumor, differentiated thyroid cancer (DTC) has a lower risk of death. It is classified papillary thyroid carcinoma (PTC) and follicular thyroid carcinoma (FTC).^[1] According to the function of trapping, organification, and storage of iodine in thyroid tissues, I-131 has been used widely for diagnosis and treatment of patients with DTC.^[2] However, during the surveillance of patient with differentiated thyroid cancer, it exists many false-positive uptake of iodine-131.^[3]

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RW is contributed equally to this work.

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Department of Nuclear Medicine, West China Hospital of Sichuan University, Guoxue Alley, Chengdu, Sichuan, People's Republic of China.

* Correspondence: Chengzhong Fan, 37 Guoxue Alley, Department of Nuclear Medicine, West China Hospital, Sichuan University, Chengdu 610041, People's Republic of China (e-mail: chengzhong.fan@scu.edu.cn).

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2. Case report

A 44-year-old woman with a papillary thyroid carcinoma for the purpose of ablation therapy after a total thyroidectomy. A whole-body scintigraphy was performed 48 hours after oral administration of 5 mCi I-131. The image showed intensive uptake by thyroid remnant and a focus of increased activity was seen in right upper abdomen (Fig. 1A). Metastatic disease was considered to be differentiated from other false-positive conditions. Meanwhile, a SPECT/CT fusion imaging was carried out (Fig. 1B), the focus of I-131 intensive uptake in the right upper abdomen on the WBS was localized at the descending duodenum with a sacculated structure (top CT and bottom fusion) by diagnostic CT, which indicated a suspected duodenum diverticulum.

Then a 30minutes dynamic scan was carried out after intravenously injected 5 mCi of Technetium-99m pertechnetate. A serial of images (frame/min) showed a focus of increased activity in the right upper abdomen supporting a suspected duodenum diverticulum (Fig. 2).

Another SPECT/CT fusion imaging was subsequently performed to localize the focus of increased radioactivity on the dynamic imaging after orally administrated 300 mL of 3% iodine contrast agent (Fig. 3). The focus of the increased radioactivity in the right upper abdomen disappeared (middle SPECT). Meanwhile, iodine contrast agent filling in the sacculated focus at the descending duodenum was found

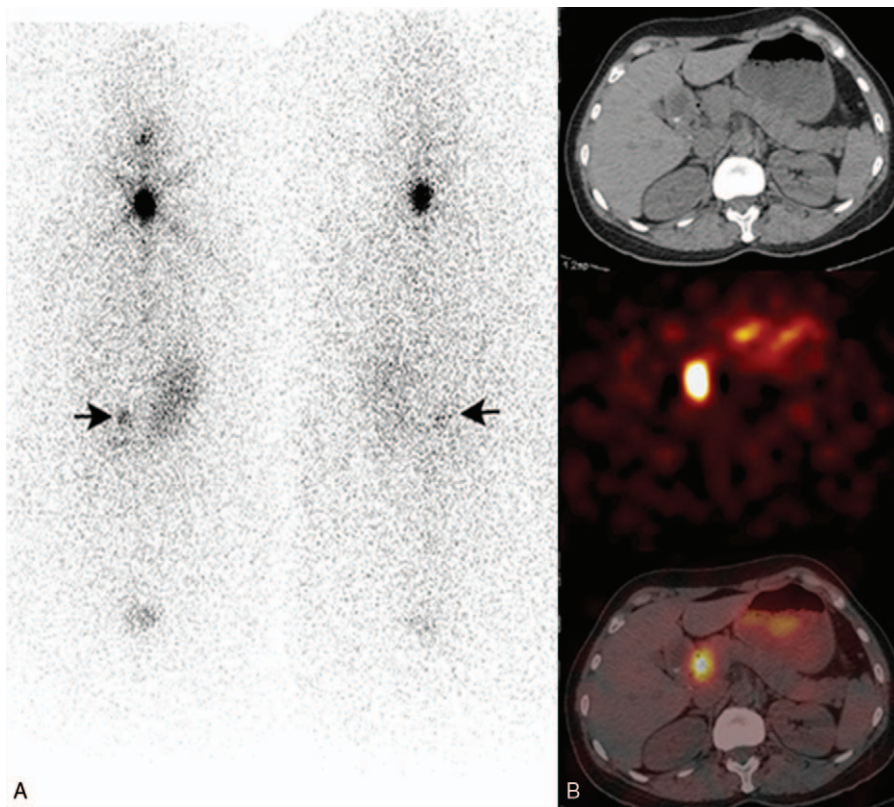


Figure 1. (A) whole body bone scintigraphy showed a focus of increased activity in right upper abdomen. (B) A SPECT/CT fusion imaging (top CT, middle SPECT, bottom fusion) found the focus of I-131 intensive uptake in the right upper abdomen localizing at the descending duodenum with a sacculated structure on CT. SPECT/CT = single-photon emission computed tomography/computed tomography.

(top CT and bottom fusion). Combining the results of previous imagings (Figs. 1 and 2), a descending duodenum diverticulum was diagnosed and a variant anatomy from a metastasis of tumor was differentiated. Nevertheless, the patient had no

manifestations including obstruction, perforation, and bleeding. This patient was then treated with conservative treatment, such as diet regulation, rest, appropriate use of antacids, and antispasmodic agents, etc.

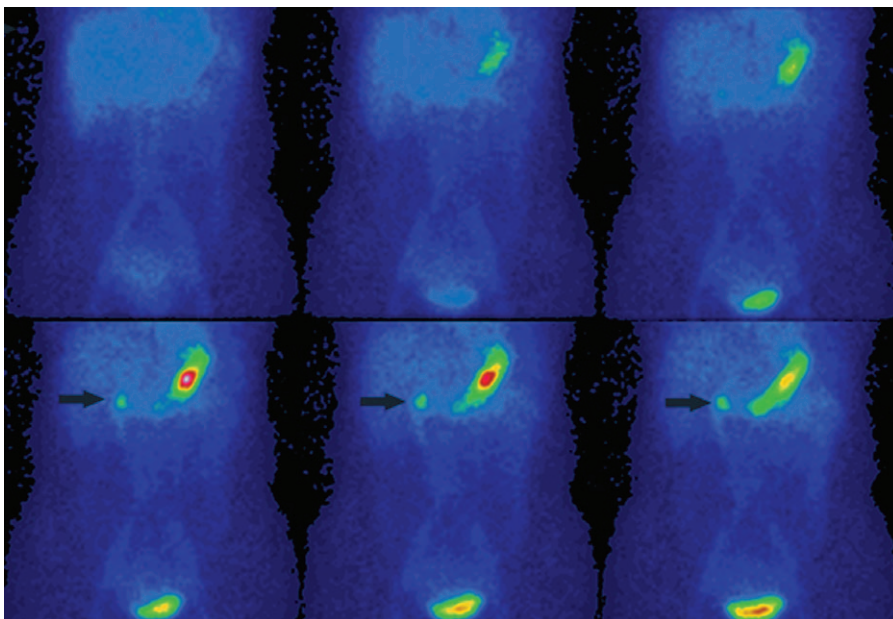


Figure 2. A 30-minute dynamic scan after administering 5 mCi of Technetium-99m pertechnetate intravenously showed a focus of increased activity in the right upper abdomen.

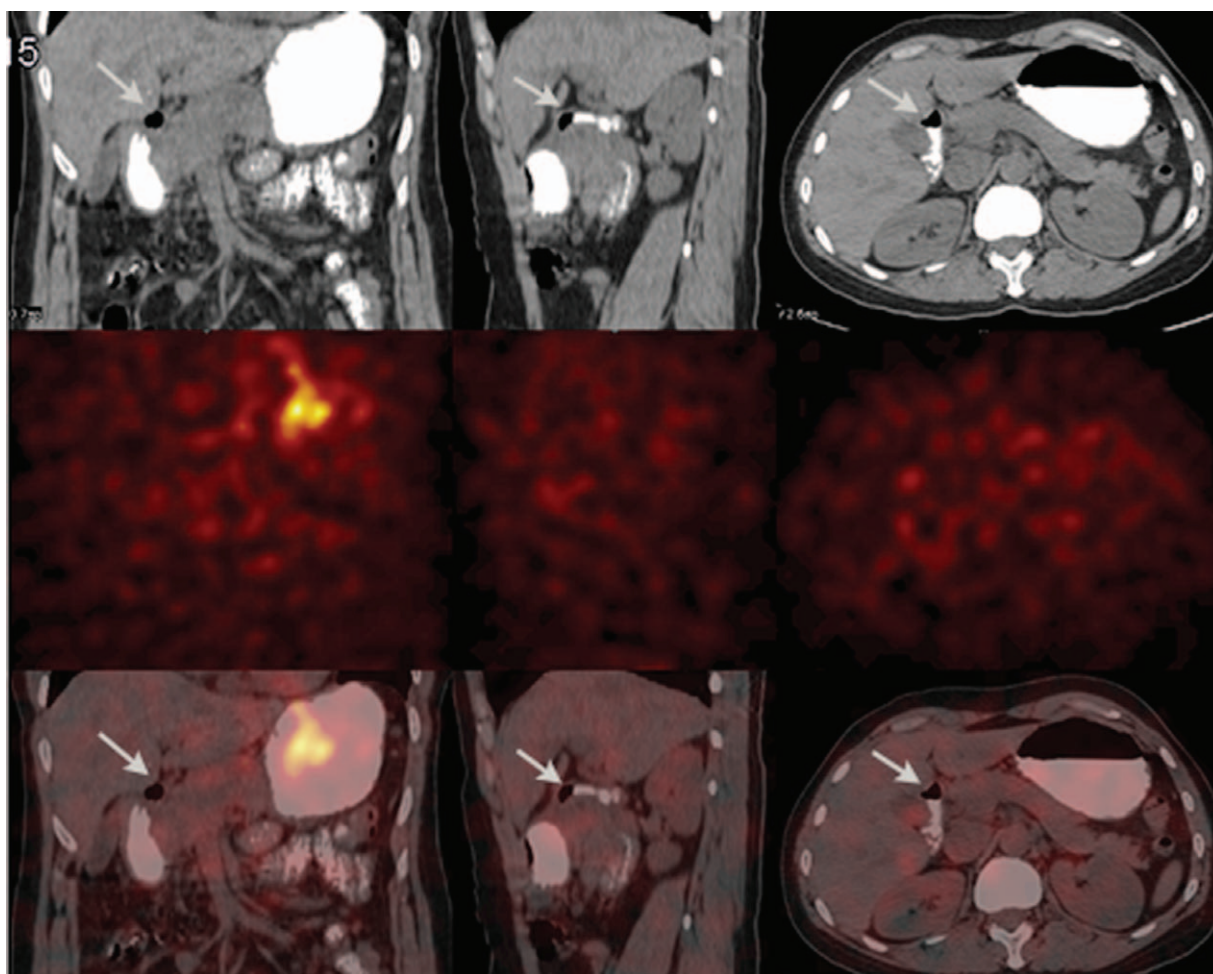


Figure 3. Another SPECT/CT fusion imaging was performed after orally administered 300 ml of 3% iodine contrast agent (top CT, middle SPECT, bottom fusion; left coronal, middle sagittal and right transverse) showed no increased radioactivity in the right upper abdomen (middle SPECT). However, iodine contrast agent filling in the sacculated focus at the descending duodenum was found (top CT and bottom fusion). A cross-channel between the gastrointestinal tract and the diverticulum of descending duodenum was demonstrated. SPECT/CT = single-photon emission computed tomography/computed tomography.

This case report was approved by the Ethics Committee of the West China Hospital of Sichuan University, Chengdu, China, and the written informed consent was obtained.

3. Discussion

Iodine-131 (I-131) whole-body scan (WBS) is an effective method in the management of patients with differentiated thyroid carcinoma (DTC), to visualize thyroid remnants and recurrent or metastatic disease. However, many physiological or false-positive I-131 WBS findings have been reported in the literature. Being aware of possible physiological or false-positive findings is very important for clinicians to avoid misinterpretations of the I-131 WBS, which could bring about inappropriate treatments.^[4] During the surveillance of patient with differentiated thyroid cancer, it exists many false-positive uptake of iodine-131 in benign diseases such as cyst and inflammation, or in a variety of benign and malignant non-thyroidal tumors and even some healthy tissues including thymus, breast, liver, and gastrointestinal tract.^[3]

Our report described a case of DTC with localization of I-131 accumulation in the duodenum diverticulum that resulted in a

false-positive scan. A focus of I-131 uptake outside the thyroid bed is suggestive of a distant metastatic disease and it is easy to be misdiagnosed as residual iodine in the gastrointestinal tract due to its proximity to the gastric antrum. Although the mechanism of increased ¹³¹I uptake in the diverticulum is not fully understood, it can be concluded that functional sodium-iodide symporter (NIS) expression in gastrointestinal tract may be the main reason that causes the uptake of I-131 because NIS in the cell membrane makes I-131 of the blood against chemical and electrical gradients into cells.^[5] Meanwhile, some ectopic thyroid tissues in tongue, thyroglossal duct, lateral neck, mediastinum and subphrenic organs, or even ovarian can express the NIS normally and then uptake the I-131, some non-thyroid tissues or organs such as salivary glands, lacrimal gland, nasopharynx, stomach and breast can also have the character of expression of NIS protein and uptake of I-131. Therefore, tumors derived from these tissues, such as gastric adenocarcinoma, teratoma, breast disease, and lung adenocarcinoma, can express NIS and uptake I-131.^[6] Besides there is also additional mechanisms of radioiodine uptake via retention of body fluid containing radioiodine, which is commonly seen in ectopic gastric mucosa as Meckel's diverticulum, hiatal hernia, and Barrett esophagus.^[7-9] In

addition, the diverticulum is often accompanied by bleeding and inflammation, radioactive iodine can enter through vascular diverticulum. The blood supply and vascular permeability in these inflammatory regions can be significantly increased, and the ability to concentrate or retain I-131 in the corresponding parts is also greatly improved.^[10]

Commonly, false positive uptake of iodine by diverticulum often manifests itself as Meckel diverticulum, often seen in children. However, our case is a diverticulum of the descending duodenum, which is rarely reported in previous reports.^[7-9] The additional information of the lesion obtained from SPECT/CT fusion imaging with oral administration of iodine contrast agent visualized the focus of radioactivity in the right upper abdomen flowing out (Fig. 3, middle SPECT) and the iodine contrast agent filling in the sacculated focus at the descending duodenum (Fig. 3, top CT and bottom fusion). The SPECT/CT fusion imaging with oral administration of iodine contrast agent confirmed a cross-channel between the gastrointestinal tract and the diverticulum of descending duodenum by the iodine contrast agent from the stomach filling into the diverticulum. So both foci of the I-131 and Tc-99m pertechnetate accumulation in the diverticulum of descending duodenum were not because the diverticulum uptook I-131 and Tc-99m pertechnetate but because the I-131 and Tc-99m pertechnetate flowed into the diverticulum through the cross-channel between the gastrointestinal tract and the diverticulum. A descending duodenum diverticulum was diagnosed and a variant anatomy from a metastasis of tumor was differentiated. It is very useful to reduce the misinterpretation of the scan in some degree and should be promoted more widely in the follow-up of DTC patients, particularly when I-131 whole-body scan has an abnormal positive scan.^[11,12]

In conclusion, diverticulum of the descending duodenum should be considered in cases in which abnormal uptake in the

right upper abdomen is detected on I-131 whole-body scan after differentiated thyroid cancer resection. SPECT/CT is helpful to minimize false-positive findings in evaluation of differentiated thyroid cancer.

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