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Case report

Unusual False Positive Radioiodine Uptake on ^{131}I Whole Body Scintigraphy in Three Unrelated Organs with Different Pathologies in Patients of Differentiated Thyroid Carcinoma: A Case Series

Rohit Ranade, Shwetal Pawar[1], Abhishek Mahajan[2], Sandip Basu

Radiation Medicine Centre, Bhabha Atomic Research Centre, Tata Memorial Centre Annexe, [1]Department of Nuclear Medicine, Seth Gordhandas Sunderdas Medical College and King Edward Memorial Hospital, [2]Department of Radiology, Tata Memorial Hospital, Mumbai, Maharashtra, India

Abstract

Three cases with unusual false positive radioiodine uptake in three different organs and pathologies (infective old fibrotic lesion in the lung, simple liver cyst, and benign breast lesion) on iodine-131 (^{131}I) whole body scintigraphy. Clinicoradiological correlation was undertaken in all three cases and the pathologies were ascertained. In all the three cases, single-photon emission computerized tomography-computed tomography (SPECT-CT) and ancillary imaging modalities were employed and were helpful in arriving at the final diagnosis.

Keywords: Differentiated thyroid carcinoma, fluorodeoxyglucose-positron emission tomography/computed tomography, radioiodine scan, iodine-131(^{131}I) whole body scintigraphy

Introduction

^{131}I-NaI has been used very effectively over several years for both the diagnosis and therapy of differentiated thyroid carcinoma (DTC). ^{131}I whole body scintigraphy has been used for detection of remnant, residual as well as metastatic disease in patients of DTC. Though highly specific, ^{131}I whole body scans also show a number of false positive accumulations, while not many. It is essential to correctly identify these false positive lesions at the earliest in order to avoid subsequent unnecessary radioiodine treatment in these cases. Here, we present a case series of three cases of unusual false positive radioiodine uptake on whole body iodine-131 (^{131}I scan) in three different organs and three different pathologies that demonstrated this uptake.

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Case Reports

Case 1

A 36-year-old female, with diagnosis of multifocal papillary carcinoma thyroid (initial presentation with focal hypoechoic space-occupying lesion (SOL) in the right lobe (1.7 cm × 1.2 cm) with vascularity within, had undergone total thyroidectomy and treatment with 54 μCi of ^{131}I subsequently. Posttherapy scan showed multifocal iodine-avid foci in the neck. Large dose scan with ^{131}I [Figure 1a] after 6 months of therapy showed an iodine focus in the right side of the chest [thyroglobulin (Tg) and thyroid stimulating hormone (TSH) values mentioned in Table 1]. Chest x-ray was normal and as Tg was low; this iodine-avid focus in the right lung was investigated further to rule out a false positive etiology. Fluorodeoxyglucose-positron emission tomography/computed tomography (FDG-PET/CT) was done at that time, which showed a very low grade FDG uptake in a

Address for correspondence:
Dr. Sandip Basu, Radiation Medicine Centre, Bhabha Atomic Research Centre, Tata Memorial Hospital Annexe, Jerbai Wadia Road, Parel, Mumbai - 400 012, Maharashtra, India. E-mail: drsanb@yahoo.com

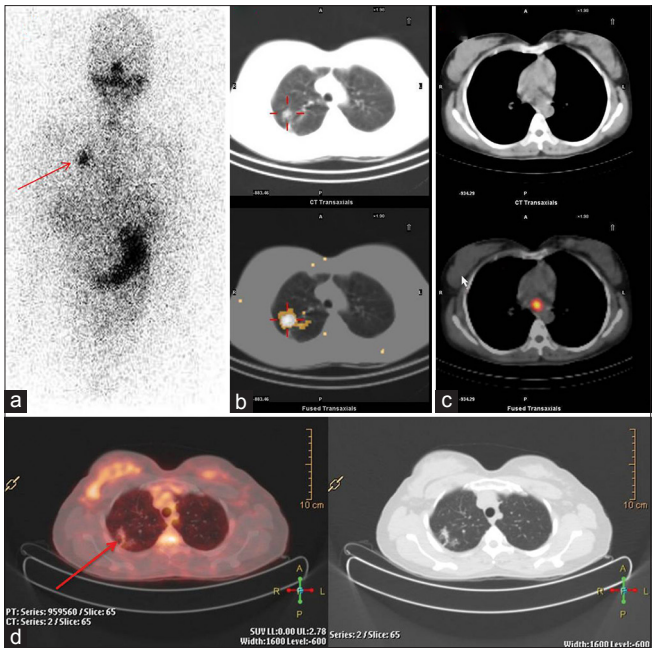

Figure 1: Planar 131I whole body scan (a) showing iodine-avid focus in the right upper lung. Correlative SPECT-CT (b and c) in the lung and mediastinal window and FDG-PET/CT images (d) showing a spiculated nonenhancing lesion with adjacent area of fibrosis in the posterior segment of the right upper lobe and 1 cm-sized round node in the subcarinal region. CT features of the lung lesion on the right were in favor of benign pathology (nonactive infective sequela)

nonactive fibrotic lesion in the right lung on computed tomography (CT), corresponding to the lesion seen in the iodine scan. The repeat diagnostic radioiodine scan was repeated after 1 year, which again showed persistence of the same lesion in the right lung (Tg and TSH values mentioned in Table 1). Correlative SPECT-CT images [Figure 1b and c] in the lung and mediastinal window and FDG-PET/CT [Figure 1d] showed a spiculated nonehnacing lesion with adjacent area of fibrosis in the posterior segment of the right upper lobe and 1 cm-sized round node in the subcarinal region. CT features of the lung lesion on the right were in favor of benign pathology (infective sequela).

Case 2

A 38-year-old female, with diagnosis of multicentric follicular variant of papillary carcinoma thyroid who had prior treatment with total thyroidectomy and 49 μCi of ^{131}I, showed iodine-avid foci in the neck and mediastinum in the posttherapy scan. Large dose scan with ^{131}I [Figure 2a] after 6 months therapy showed an iodine foci in the neck with neck uptake being 0.27% and iodine focus in the right lower chest region (Tg and TSH values mentioned in Table 2). SPECT-CT was done, which showed the focus in segment VIII of the liver that was hypodense on CT [Figure 2b]. PET-CT with FDG [Figure 2c] was done at that time, which showed non-FDG avid hypodense segment VIII liver lesion. The ultrasonography (USG) showed a well-defined lesion with posterior acoustic enhancement and no intralesional vascular flow on Doppler imaging. The T2-weighted (T2W) images revealed a well-defined hyperintense lesion, which did not show any enhancement on the postcontrast T1-weighted (T1W) magnetic resonance imaging (MRI) [Figure 2d-f]. All these imaging features were suggestive of simple cyst of the liver. Thus, with low Tg and other modalities ascertaining benign etiology, the cystic liver lesion was considered as a false positive.

Table 1: Serum Tg and TSH values of Patient 1 at various time course

	Tg (ng/mL)	TSH (μIU/mL)
Baseline	4.3	33.2
1st follow-up LDS	0.12	>100
2nd follow-up LDS	0.54	>100

LDS: Large dose scan

Table 2: Serum Tg and TSH values of Patient 2 at various time course

	Tg (ng/mL)	TSH (μIU/ml)
Baseline	1.5	60.12
1st follow-up LDS	0.54	75.2

LDS: Large dose scan

Table 3: Serum Tg and TSH values of Patient 3 at various time course

	Tg (ng/mL)	TSH (μIU/mL)
Baseline	Not done	33.2
1st follow-up LDS	3.78	>100
2nd follow-up LDS	0.01	>100

LDS: Large dose scan

Case 3

A 36-year-old female with history of follicular variant of papillary carcinoma thyroid for which she was treated with total thyroidectomy and 49 μCi of ^{131}I postoperatively, demonstrated an iodine-avid foci in the left side of the chest on large dose scan with ^{131}I after 6 months of therapy (Tg and TSH values mentioned in Table 3). The chest x-ray was normal and as Tg was low, this iodine-avid focus in the left chest region was investigated further. SPECT-CT showed iodine-avid foci in the left breast [Figure 3a and b]. Whole body FDG-PET/CT was normal. Mammogram as well as USG of both the breasts showed no focal abnormality [Figure 3c]. The patient retrospectively gave a past history of fibroadenoma excision from the left breast undertaken previously. The findings of low Tg as well as that of other imaging modalities showed normal glandular architecture of the left breast; the left breast lesion was a false positive lesion.

Discussion

^{131}I-NaI is considered as a very specific radiopharmaceutical with respect to detecting thyroid pathology, particularly

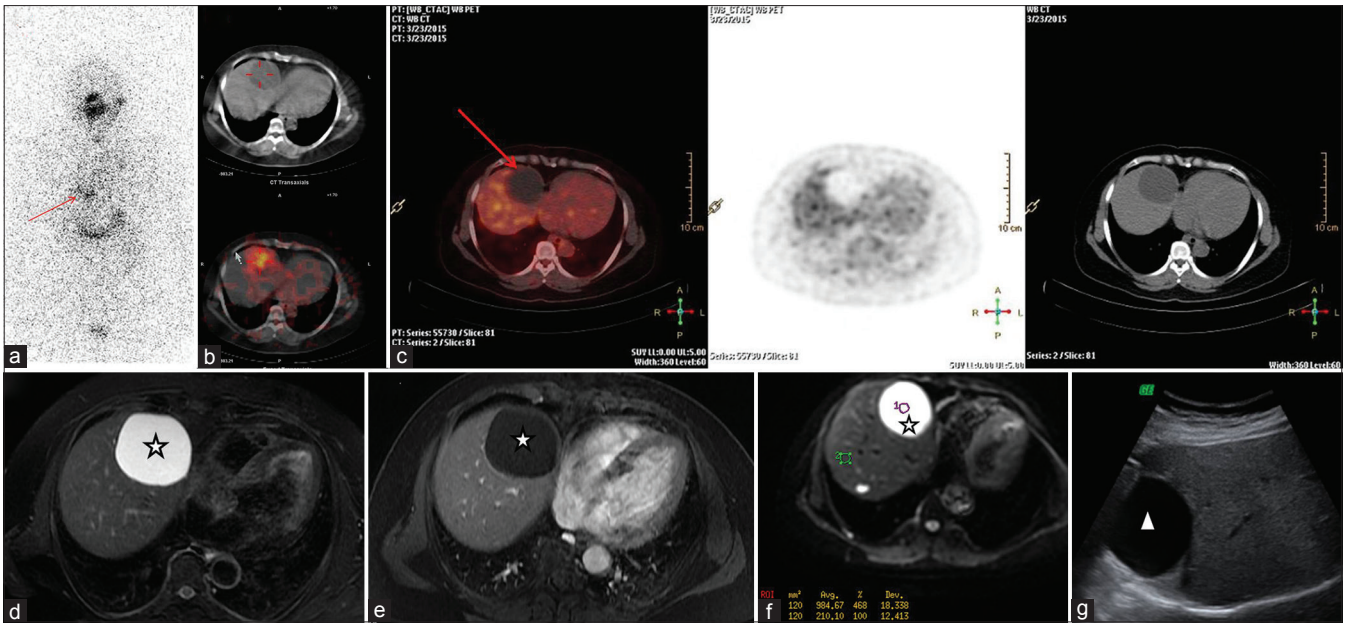

Figure 2: The diagnostic 131I scan (a) showing iodine-avid focus in segment VIII of liver; Correlative SPECT CT [Figure 2a] and PET CT images (c) in abdomen window shows a well-defined round hypodense lesion in segment VIII of the liver, which showed iodine avidity on SPECT scan. T2W image (d) showing well-defined hyperintense lesion (star) in segment VIII with no significant enhancement in postcontrast fast spoiled gradient recalled (FSPGR)-echo images (e). Diffusion MRI (f) showed facilitated diffusion with high apparent diffusion coefficient (ADC) values. The correlated USG (g) shows anechoic lesion with posterior acoustic enhancement (arrowhead). All these imaging features were suggestive of simple cyst of the liver

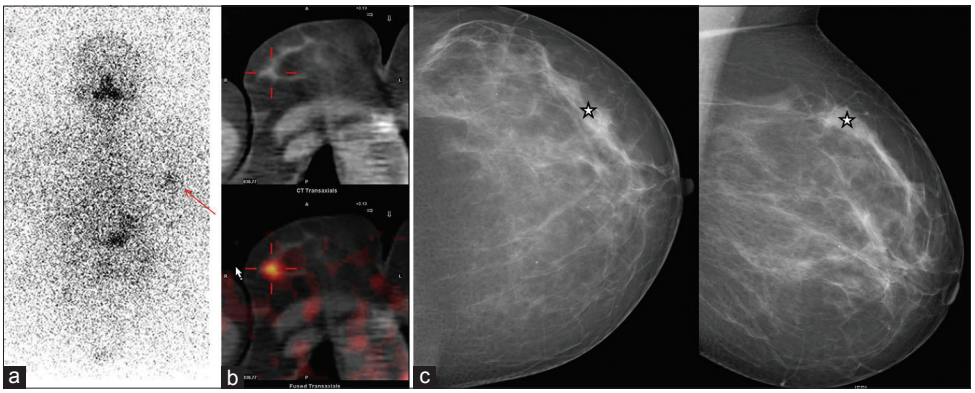

Figure 3: The large dose ^{131}I scan (a) showing iodine-avid focus in the left breast. Correlative SPECT-CT (b) showing normal glandular breast parenchyma in the area of the iodine-avid uptake. Left side of the craniocaudal (a) and mediolateral (b) view mammography (c) revealed normal scattered glandular parenchyma (star) with no obvious focal pathology/lesion; FDG-PET/CT was normal in this patient. The patient had previous history of fibroadenoma excision

in patients of DTC following thyroidectomy. The major mechanisms considered important for radioiodine uptake are:

1) Functional sodium/iodide symporter (NIS) expression (in normal tissues, including thymus, breast, salivary glands, and gastrointestinal tract, or various benign and malignant tumors of these organs), 2) Metabolism of radioiodinated thyroid hormone, 3) Retention of radioiodinated body fluids (saliva, tears, blood, urine, exudate, transudate, gastric, and mucosal secretions, etc.) associated with or without structural change, 4) Retention and uptake of radioiodine in inflamed tissue, 5) Contamination by physiologic secretions, and 6) Other unknown factors.[1]

Various authors have over the years reported the importance of identification of false positives in iodine scans in the form of case reports,[2] where false positive findings have been reported in various organs of the body. False positive radioiodine uptake in the chest has been reported due to acute respiratory infection,[3,4] pulmonary tuberculosis,[5] pulmonary aspergilloma,[6] rheumatoid lung disease,[7] and bronchiectasis.[8] It is essential to identify these false positives as pulmonary metastasis and this can be commonly encountered in

cases of DTC. Also, metastasis in the ribs is another such entity in DTC. One uncommon metastasis seen in the thoracic region is cardiac metastasis.[9] Radioiodine uptake in the breast is also not very uncommon. The important causes are lactating breasts, breast fibroadenoma,[10] breast carcinoma,[11] and breast cyst.[12] No case of metastasis to the breast from DTC has been reported. Thus, the cause of radioiodine uptake in breasts could be either physiological (lactating breasts) or pathological (abovementioned causes). Radioiodine uptake in cystic lesions is reported. It is seen in ovarian dermoid or struma ovarii,[13] nabothian cysts,[14] renal cysts,[15] ovarian cysts,[16] bronchogenic cysts,[17] and pleuropericardial cysts.[18] Till date, there is no literature regarding radioiodine uptake in case of simple cysts in the liver. False positive radioiodine uptake in cystic liver disease is reported in cases of hydatid liver disease[19] and hemangioma of the liver. Liver metastasis, though uncommon, can be encountered at times in some cases of DTC. So, focal iodine-avid lesions in the liver require careful assessment to distinguish between metastasis and false positives.

Along with whole body ^{131}I scan findings, various other factors need to be considered before ascertaining a lesion to be metastasis from DTC. The single most important factor to be considered in this is the Tg level. The Tg is expected to be raised in case of systemic metastatic lesions.[20] If the serum Tg is very low/undetectable in DTC, the organ lesion in question is metastatic. Along with Tg, it is essential to find out antithyroglobulin antibodies (antiTgAb) to ascertain any interference. In all the three cases that we have reported, Tg was very low with the antiTgAb being negative that ruled out any interference.

In cases of discordant findings of low Tg but positive ^{131}I whole body scan, SPECT-CT should be strongly considered where available. SPECT-CT has been documented to be of incremental value in the localization of iodine-avid foci in these cases where Tg is low and there is a high suspicion of false positives. In all the three cases reported, SPECT-CT played a pivotal role for the exact localization of the iodine-avid foci in the three organs. Also, the use of other correlative imaging modalities like MRI, PET-CT, and USG should be considered when in doubt. All these noninvasive modalities are of added importance in determining the exact nature of such lesions when invasive biopsy cannot be done or is refused by the patient. In all the three cases, these ancillary imaging modalities were used and were helpful in arriving at the diagnosis.

Conclusion

In the identification of false positives, ^{131}I whole body scan is crucial in the management of cases of DTC. It should be considered in discordant cases where the iodine scan is positive but Tg is low. Past history is very important in such cases and can give a clue to the origin of the false positive focus. SPECT-CT should be carried out in all such cases as it provides a definite incremental value. Other imaging modalities should be considered in these cases to ascertain whether the iodine-avid foci are metastases from DTC or not.

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