

Case Report

“Tumour sink effect” on the diagnostic or posttreatment radioiodine scan due to sequestration into large-volume functioning metastasis of differentiated thyroid carcinoma influencing uptake in smaller metastatic sites or remnant thyroid tissue: An uncommon but possible phenomenon in thyroid cancer practice

ABSTRACT

Two patients of differentiated thyroid carcinoma are illustrated demonstrating “sink effect” in posttherapeutic and diagnostic radioiodine (I-131) study: (a) in the first case, it masked the other small-volume metastatic sites (pulmonary and paratracheal nodes) in the posttreatment scan, which were clarified following metastatectomy of the large-volume skeletal metastatic lesion, and (b) in the second, interestingly, it masked the remnant thyroid uptake in the first postoperative diagnostic radioiodine study. In both the situations, large-volume highly functioning skeletal metastasis was the cause for the observed “sink effect” and is presented as learning illustrations to the attending physicians. Although uncommon, this is a possible phenomenon in thyroid cancer practice.

Keywords: Differentiated thyroid carcinoma, I-131, radioiodine scan, thyroid carcinoma, tumor sink effect

INTRODUCTION

In the thyroid cancer practice, “tumor sink effect” is a perceived phenomenon among metastatic lesions of differentiated thyroid carcinoma that is commonly observed in two clinical situations: (i) a highly active metastatic focus/site masks radioiodine uptake in the relatively lesser active lesions, which only become apparent/clearer with subsequent therapies as the highly active lesion becomes quiescent and (ii) in the dose-responsive imaging, the lesser active lesions become prominent in the posttreatment scans, not otherwise identified on diagnostic study. In the radioiodine imaging, such situation is more commonly encountered when metastatic thyroid carcinoma foci are obscured by the relatively large remnant thyroid tissue (which usually acts as the “first filter” for I-131). Herein, we present two cases of the sink effect on radioiodine study, one obscuring uptake in small-volume metastatic pulmonary lesions, and in the other, the remnant thyroid tissue.

CASE REPORTS

Case 1

A 72-year-old male presented with a history of neck swelling of 2-year duration. Computed tomography (CT)

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scan undertaken in an outside center had demonstrated an space occupying lesion (SOL) in the isthmus and the right lobe of the thyroid gland and cervical lymph node enlargement. He underwent surgery for the same (with reported histopathology to be follicular variant of papillary carcinoma of the thyroid [PCT]), without any radioiodine ablation at that time (in view of its nonavailability locally, in a remote village). Few years after the surgery, he started complaining of swelling over the anterior chest wall which was progressively increasing in size. CT of the chest demonstrated a lytic lesion in the manubrium sternum, paratracheal lymph nodes, and lung parenchymal nodules. The patient was referred for high-dose ablation therapy. After completing a diagnostic ¹³¹I scan, the patient received 256 mCi of ¹³¹I. Posttherapy scan showed avid concentration in the sternal mass and in the left side of the neck [Figure 1]. After the 6-month follow-up, ¹³¹I scan showed avid tracer concentration in the sternal mass with no other abnormal tracer concentration. He was treated again with 210 mCi of ¹³¹I and was counseled for feasibility of surgery for reducing the morbidity related to the large-volume metastasis and enhancing the quality of life. Post therapy, the patient was called for the assessment after 3 months, during which time he complained of progressive increase in the sternal mass lesion. The patient was considered for the assessment of metastatectomy and he underwent total excision of manubrial mass lesion with reconstruction using

flaps. Postsurgery, whole-body ¹³¹I scan at 4 weeks showed multiple lung lesions and left-sided neck nodes, which were not visualized earlier [Figure 2].

Case 2

The second case was a 54-year-old female, who initially presented with anterior neck swelling for 8 years and had recent complaints of pain and a swelling on the right arm for 1-month. The magnetic resonance imaging showed 11 cm × 9.6 cm × 8 cm skeletal lesion involving the body of right scapula extending to the coracoid and spinous processes. X-ray of the shoulder showed a lytic lesion at the same site. A biopsy from the lesion showed it as metastatic lesion from PCT. The fine-needle aspiration cytology from the left thyroid nodule showed it as a follicular variant of PCT (Bethesda Category VI). She underwent external radiotherapy to the right shoulder of 20 Gy in five fractions. Subsequently, the patient underwent total thyroidectomy with central compartment clearance and lateral selective neck dissection. A 2 mCi radioiodine ¹³¹I scan after 4 weeks of the surgery showed multiple iodine-avid skeletal (the right scapula, D8 and D10 vertebrae, and the left femur). No iodine-avid focus in the neck was noted, with 24-hour neck uptake being 0.41% [Figure 3]. The serum thyroglobulin at this time was 235 ng/ml and thyroid-stimulating hormone was > 100 µU/ml. The posttreatment study before discharge from the isolation ward had demonstrated the neck focus but in much more fainter compared to the scapular lesion.

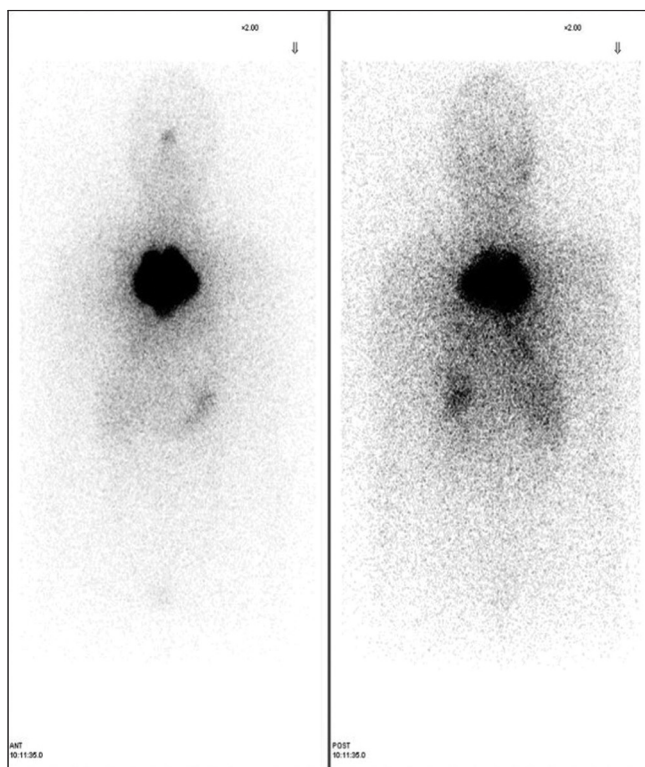


Figure 1: Posttherapy radioiodine scan showing avid concentration in the sternal mass and low-grade uptake in the lungs in the posterior view

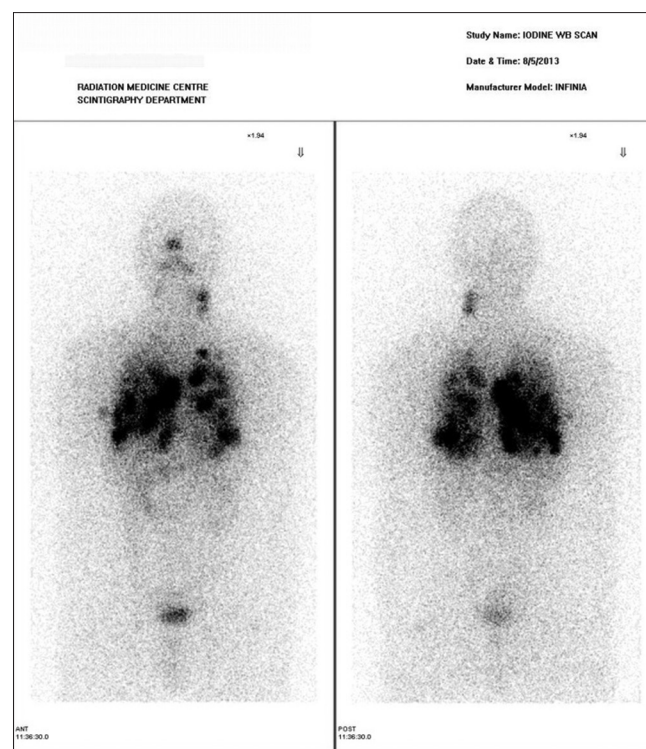


Figure 2: Postmetastatectomy whole-body I-131 scan at 4 weeks showing multiple lung lesions and left-sided neck nodes, which were not visualized earlier

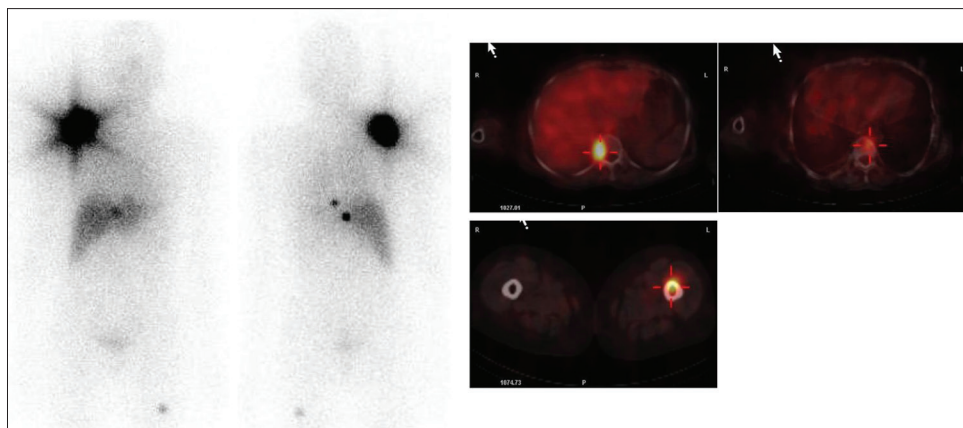


Figure 3: A 2 mCi diagnostic I-131 scan at 4 weeks following surgery demonstrating multiple iodine avid skeletal lesions (the right scapula, D8 and D10 vertebrae, and the left femur). No iodine avid focus in the neck is noted; the 24-h neck uptake was 0.41%

DISCUSSION

"Tumor Sink effect" or simply the "sink-effect" is a phenomenon observed in radionuclide imaging, where highly functional tissue/disease foci sequester the radiotracer probing the particular metabolic pathway parallel to the activity in the tissue. A traditionally recognized effect has been observed in the ^{131}I -MIBG imaging where cardiac activity would be absent in the presence of a highly functional pheochromocytoma. Similarly, there has been literature description of tumor sequestration of ^{68}Ga -DOTA-octreotate, leading to a sink effect that decreased activity concentration in healthy organs.^[1] Recently, such phenomenon has also been described in the context of prostate carcinoma therapy with ^{177}Lu -PSMA-617 therapy,^[2] where kidney and salivary gland uptakes were inversely related to the total tumor volume, a phenomenon akin what is observed in the context of diagnostic ^{131}I -MIBG imaging.

Thus, in the presented case vignettes, we observed that in the presence of large-volume metastatic lesions, the smaller metastatic lesions and the remnant thyroid tissue were not visualized/faintly visualized (with varying degree of concentration) on posttherapeutic and diagnostic scans; in the first case, the lesions were more distinctively revealed on postmetastatectomy; while in the second case, it was sparingly visible in the posttherapy ^{131}I scan.

The nonvisualization or faint visualization of these smaller lesions is due to the avid trapping of radioactive iodine in large-volume metastasis, leading to less availability of radioiodine for these smaller lesions.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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