
The Added Clinical Value of ^{18}F -FDG PET/CT in Evaluating Intratracheal Recurrence of Differentiated Thyroid Carcinoma: Implications for Planning Surgery, Assessing Its Completeness, and Planning Radioiodine Therapy

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In selected patients with differentiated thyroid carcinoma, ^{18}F -FDG PET/CT has been shown to have added value. We present 2 clinical examples in the settings of both iodine-concentrating and non-iodine-concentrating lesions with tracheal involvement with special reference to its importance in planning of surgery or radioiodine therapy and assessing completeness of surgery. We believe that the use of PET/CT should be considered on a case-by-case basis and specifically when SPECT/CT is unavailable or has inconclusive findings.

Key Words: differentiated thyroid carcinoma; FDG PET-CT; I-131; radioiodine therapy; intratracheal extension

J Nucl Med Technol 2013; 41:302–305

DOI: 10.2967/jnmt.113.127910

This article presents 2 clinical examples of the added value of ^{18}F -FDG PET/CT in managing neck recurrences of differentiated thyroid carcinoma (in the settings of both iodine-concentrating and non-iodine-concentrating lesions) with tracheal involvement. Special reference has been made to its importance with respect to the planning of surgery or ^{131}I therapy.

CASE REPORTS

The first case was of a 67-y-old man who presented with an iodine-concentrating neck recurrence 2 y after radioiodine ablation therapy with 1,961 MBq (53 mCi) of ^{131}I . The original tumor was differentiated papillary carcinoma of the thyroid with no evidence of nodal metastasis. The whole-body scan at that time (obtained with 82.88 MBq [2.24 mCi] of ^{131}I) demonstrated foci of intense tracer uptake in the neck (midline and to its left). The stimulated serum thyroglobulin level was more than 250 ng/mL, the

usual maximum titer that is provided at our institutional laboratory. Whole-body ^{18}F -FDG PET/CT (Fig. 1) demonstrated a soft-tissue mass from the retrotracheal region in the left posterolateral aspect and encroaching on almost the entire lumen except for the right anterolateral aspect. An endoscopic view of the tumor showed it to be a left-sided tracheal mass just below the cricoid cartilage and extending over 2 rings. The tumor was widely excised with the first and second tracheal rings and adjacent paratracheal muscle coupled with tracheostomy. Overall, the tumor tissue measured $2.5 \times 2.5 \times 1.5$ cm macroscopically. The histopathology report confirmed well-differentiated papillary thyroid carcinoma with invasion into the paratracheal muscle and tracheal cartilage. Two months after surgery, ^{18}F -FDG PET/CT (Fig. 2) demonstrated persistent ^{18}F -FDG uptake in the retrotracheal and left paratracheal regions (though less intense than in the presurgical study) but not demonstrating any extension or evidence of disease into the tracheal lumen. The diagnostic ^{131}I study (with 129.5 MBq [3.5 mCi]) showed 2 distinct foci of tracer uptake in the neck, one at midline and the other on the left side. Thus, from the findings of both scans it could be concluded that although the intratracheal recurrence was completely removed during the surgery, disease in the left paratracheal and retrotracheal regions had not been completely removed and needed further treatment with radioiodine. The patient was treated with 5.55 GBq of ^{131}I , and the posttherapy scan (Fig. 3) demonstrated 2 foci of radioiodine uptake in the neck corresponding to the foci noted in the diagnostic ^{131}I study and on ^{18}F -FDG PET/CT.

The second case was of a 74-y-old woman with differential thyroid carcinoma whose disease had been well controlled for 10 y but who then presented with a recent onset of increasing serum thyroglobulin (the most recent unstimulated thyroglobulin level had been 19 ng/mL). The original tumor was papillary carcinoma of the thyroid with extrathyroidal extension, with 1 of 3 lymph nodes showing evidence of metastasis. Whole-body radioiodine scanning (obtained with 118.4 MBq [3.20 mCi] 72 h after oral administration of ^{131}I) showed no focal uptake suggestive of active disease (Fig. 4). The thyroid-stimulating hormone

Received Jun. 19, 2013; revision accepted Aug. 8, 2013.

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Published online Oct. 24, 2013.

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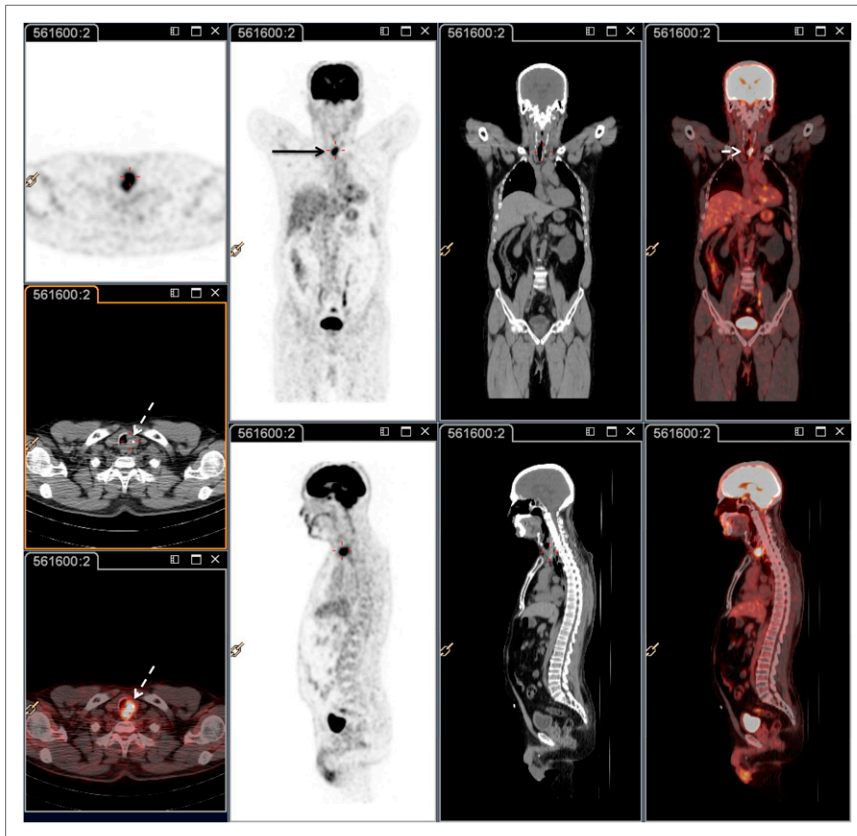


FIGURE 1. Whole-body ^{18}F -FDG PET/CT scan of case 1 demonstrating soft-tissue mass from retrotracheal region and left posterolateral aspect that encroaches almost entire lumen except for right anterolateral aspect.

level at the time of the ^{131}I scan was more than $100 \mu\text{IU/mL}$. The patient was on a low-iodine diet as part of our routine protocol, and care was taken to exclude the possibility of

a false-negative ^{131}I result due to iodine interference. ^{18}F -FDG PET/CT (Fig. 5) showed a focus of intense ^{18}F -FDG uptake arising from the posterolateral aspect of the left side of the

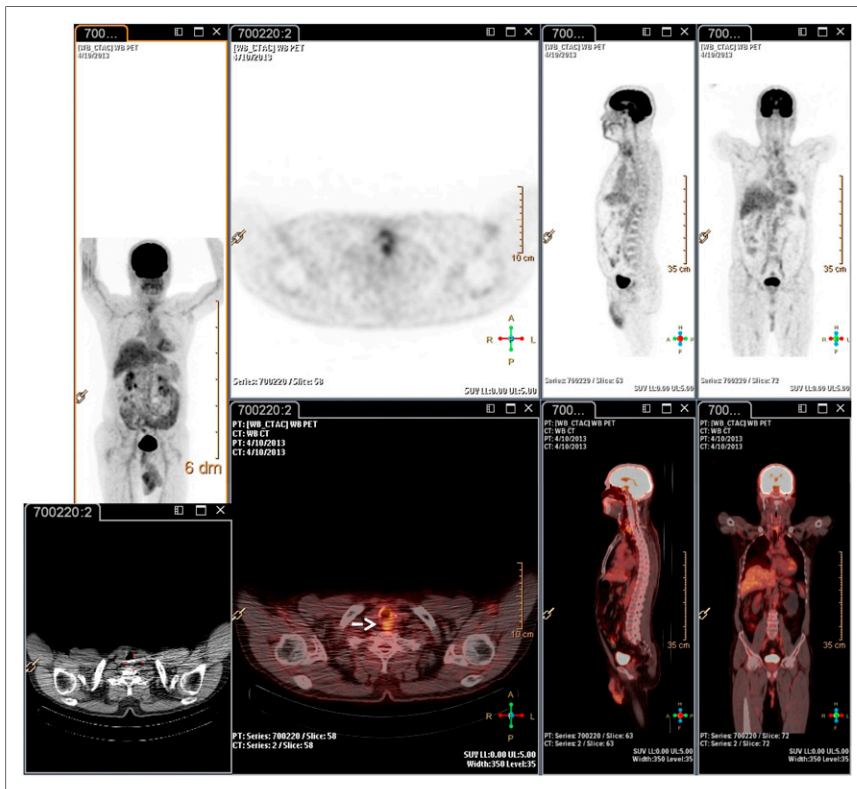


FIGURE 2. ^{18}F -FDG PET/CT scan (2 mo after surgery) demonstrating persistence of ^{18}F -FDG uptake in retrotracheal region (though less intense than in presurgical study).

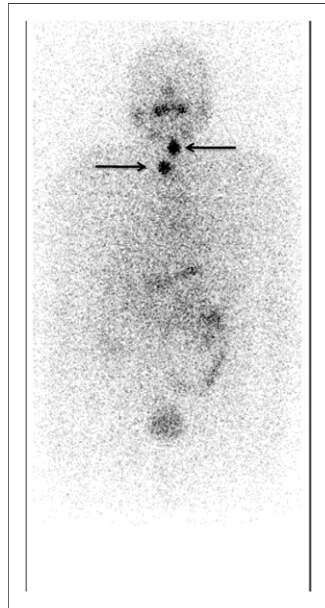


FIGURE 3. Posttherapy ^{131}I scan demonstrating 2 foci (arrows) of radioiodine uptake in neck.

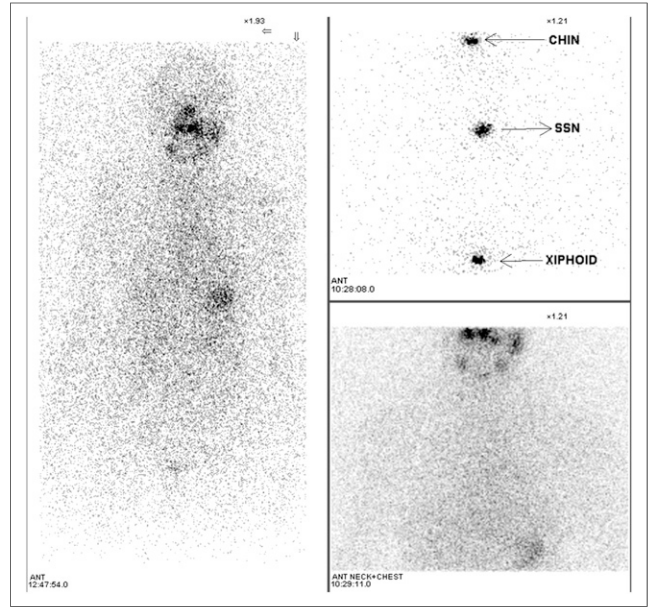


FIGURE 4. Whole-body radioiodine scan of case 2, which does not demonstrate any uptake to suggest focus of active disease. SSN = suprasternal notch.

trachea and protruding into the lumen. A less intense focus seen in left level IV was shown on ultrasonography-guided fine-needle aspiration cytology to be metastatic from differential thyroid carcinoma. Left level IV nodal dissection and excision of an intratracheal soft-tissue mass measuring $1.2 \times 1 \times 0.8$ cm was performed. The final histopathologic report confirmed the presence of metastatic papillary carcinoma in

the intratracheal soft-tissue specimen and in 1 of 5 nodes, with perinodal extension. Follow-up ^{18}F -FDG PET/CT showed no abnormal foci suggestive of residual disease, implying that the surgery had been adequate. The follow-up

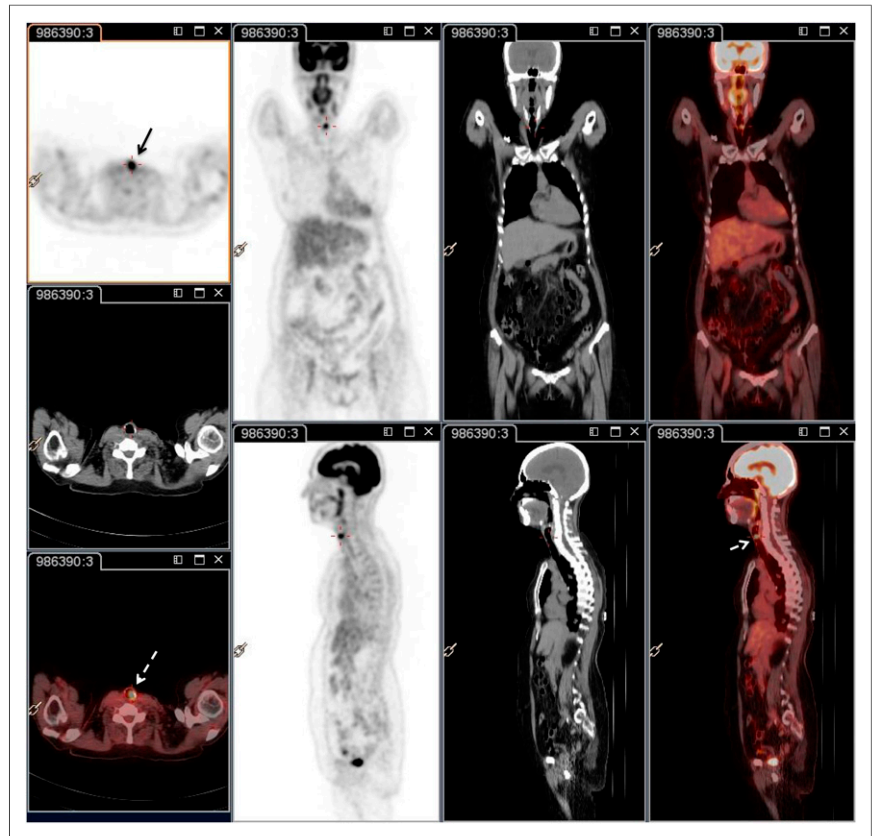


FIGURE 5. ^{18}F -FDG PET/CT scan demonstrating focus of intense ^{18}F -FDG uptake that arises from left side of trachea (from posterolateral aspect) and protrudes into lumen (clearly visualized in triangulated transaxial, sagittal, and coronal slices of fused images). Also observed is less intense focus in left level IV, which on ultrasonography-guided FNAC was found to be metastasis from differential thyroid carcinoma.

level of stimulated thyroglobulin was 2.1 ng/mL, and the patient is being observed on a regular basis.

DISCUSSION

The first case, of iodine-concentrating disease, classically demonstrates the importance of determining whether a recurrent neck lesion noted on planar ^{131}I imaging extends within the trachea and thus requires tracheostomy before ^{131}I therapy. Non-contrast-enhanced CT is imperative in this scenario, taking into account that such patients may be potential candidates for radioiodine therapy should the surgeon deem surgery not feasible. Thus, non-contrast-enhanced ^{18}F -FDG PET/CT may serve a valuable role. Obviously, for accurate surgical planning, such characterization is pivotal (as seen in both cases), but equally important is evaluating the completeness of surgery and planning future ^{131}I therapy of the residual lesions.

CONCLUSION

These two cases of differential thyroid carcinoma emphasize 3 added clinical benefits of ^{18}F -FDG PET/CT: in the evaluation of patients who have an elevated level of thyroglobulin but negative findings on iodine scintigraphy, in disease prognostication, and in the detection of second malignancies. Various reports have also mentioned the utility of ^{18}F -FDG PET/CT for evaluating suspected neck recurrences (1–5). The present communication exemplifies yet another advantage in applying ^{18}F -FDG PET/CT to clinical decision making in patients with differential thyroid carcinoma. In both of our patients, the added value shown for ^{18}F -FDG PET/CT in determining tracheal in-

volvement, intratracheal extension, and the completeness of surgery had important decision-making implications for surgery and radioiodine therapy. The new hybrid systems that use state-of-the-art spiral CT scanners (up to 16-slice scanners that can generate images of diagnostic quality) can be of great value in precisely evaluating iodine-avid neck recurrences. We believe that with the availability of more such advanced SPECT/CT instruments, the use of PET/CT should be considered on a case-by-case basis and specifically when SPECT/CT is unavailable or has inconclusive findings.

DISCLOSURE

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Ozkan E, Soydal C, Araz M, Aras G, Ibis E. The additive clinical value of ^{18}F -FDG PET/CT in defining the recurrence of disease in patients with differentiated thyroid cancer who have isolated increased antithyroglobulin antibody levels. *Clin Nucl Med.* 2012;37:755–758.
2. Kunawudhi A, Pak-art R, Keelawat S, Tepmongkol S. Detection of subcentimeter metastatic cervical lymph node by ^{18}F -FDG PET/CT in patients with well-differentiated thyroid carcinoma and high serum thyroglobulin but negative ^{131}I whole-body scan. *Clin Nucl Med.* 2012;37:561–567.
3. Ozkan E, Aras G, Kucuk NO. Correlation of ^{18}F -FDG PET/CT findings with histopathological results in differentiated thyroid cancer patients who have increased thyroglobulin or antithyroglobulin antibody levels and negative ^{131}I whole-body scan results. *Clin Nucl Med.* 2013;38:326–331.
4. Davison JM, Stocker DJ, Montilla-Soler JL, et al. The added benefit of a dedicated neck F-18 FDG PET-CT imaging protocol in patients with suspected recurrent differentiated thyroid carcinoma. *Clin Nucl Med.* 2008;33:464–468.
5. Kaneko K, Abe K, Baba S, et al. Detection of residual lymph node metastases in high-risk papillary thyroid cancer patients receiving adjuvant I-131 therapy: the usefulness of F-18 FDG PET/CT. *Clin Nucl Med.* 2010;35:6–11.