

# Clinical Usefulness of FDG PET in Differentiated Thyroid Cancer

**W**ell-differentiated thyroid cancer is recognized as being one of the most curable of all neoplasms. This low mortality is attributed to effective surgical resection of the primary tumor, subsequent  $^{131}\text{I}$  ablation or therapy, and more sensitive methods of detecting disease. Recurrent disease detection has been aided by thyroglobulin (Tg) and recombinant thyroid-stimulating hormone (rTSH), which in combination simplifies the process of detecting recurrent tumor. FDG PET appears to be effective in aiding the clinician in determining recurrence of disease as is described in the article by Schlüter et al. (1). The advent of FDG PET in the clinical arena is most welcome for most nuclear medicine practitioners, but its application in thyroid cancer evaluation deserves special attention because this is where our current practice has its greatest diagnostic and therapeutic impact.

The overall risk of recurrence of differentiated thyroid cancer is 20%. At the time of initial surgery, the risk of recurrence is related to age at diagnosis, metastases, extent of disease, and size of lesion (e.g., AMES). The prognosis of patients with recurrent disease or metastatic disease depends on the size and extent of tumor when detected (2). Surveillance for recurrence is a lifelong process and uses conventional imaging techniques such as  $^{131}\text{I}$  or  $^{123}\text{I}$  scanning when serum TSH is elevated to determine the presence of iodine-avid disease. Radiologic methods that are used include CT of the chest to determine lung metastases, MRI for monitoring brain metastases, and sonography of the neck for nodal disease or local recurrence. The use of rTSH in lieu of hypothyroid preparation for rTSH dosimetry improves the quality of life of patients during diagnostic assessment. The use of Tg levels, especially after TSH stimulation, improves the sensitivity for detecting the presence of disease and assists in monitoring response to therapy. rTSH dosimetry allows risk assessment in 1 wk compared with the 6–8 wk necessary by inducing hypothyroidism with thyroid hormone withdrawal.

However, detection of noniodine-avid disease in patients with elevated Tg levels continues to be difficult. The article by Schlüter et al. (1) in this issue of *The Journal of Nuclear Medicine* focuses on this subgroup of patients with negative

iodine dosimetry scans and elevated hTg levels. These authors report that noniodine-avid thyroid cancer can be detected frequently with FDG PET. Patient management is improved because when localized disease is identified, surgery or focused radiotherapy could be used to eradicate tumor.

Several studies have shown the imaging pattern of high FDG PET uptake in noniodine-avid lesions. PET scanning is particularly likely to be useful if the Tg level is elevated (3,4). FDG PET may also give prognostic information. We have found that patients with FDG-avid lesions appear to be a more aggressive subset in this group of patients. Furthermore, patients with FDG-avid, high-volume disease (>125 mL) as assessed with CT and PET have markedly reduced survival (5). FDG PET is a tool for assisting in the clinical decision making for either localized or systemic therapy other than the use of  $^{131}\text{I}$  in patients with negative iodine scans and elevated hTg. A trial of  $^{131}\text{I}$  therapy is usually prudent in an effort to “kill any remaining differentiated components” of the metastases. Differentiating agents such as retinoic acids could be used (6). Our group has used somatostatin therapy and FDG PET as a method of monitoring response to therapy (7). Future applications of this methodology would be with  $^{124}\text{I}$  for more accurate localization of disease with the added bonus of more accurate tumor dosimetry to predict dose delivery (8). Obviously, one limitation of this method is the availability of  $^{124}\text{I}$ , but its half-life of 4.02 d is quite appropriate for distribution if PET becomes widely available. Ultimately, the biologic characterization of these tumors using PET with more specific tracers will hopefully allow us to noninvasively select the more aggressive subset of patients who will tend to progress in the future.

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