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Focal Thyroid Uptake in Thyroid Incidentalomas Detected by PET Scans Suggests Malignancy

Soelberg KK, Bonnema SJ, Brix TH, Hegedüs L. Risk of malignancy in thyroid incidentalomas detected by (18)F-fluorodeoxyglucose positron emission tomography: a systematic review. Thyroid. July 24, 2012 Jul 24. [Epub ahead of print].

SUMMARY

Background

The use of 18F-fluorodeoxyglucose positron-emission tomography (18F-FDG–PET) scans for screening and follow-up of cancer has increased substantially and has led to detection of lesions in the thyroid gland that were not evident clinically. These lesions have been dubbed "thyroid incidentalomas," and they are found even more commonly by ultrasound as well as by other imaging methods. However, finding them by PET scanning has been considered more ominous because PET scans depend on the uptake of labeled glucose that is based on the fact that malignancies metabolize glucose at a higher rate than normal tissues. In addition, it is known that thyroid malignancies have increased expression of glucose transporters as compared with normal thyroid tissue (1).

The current study is a review of the literature on thyroid incidentalomas found by PET scanning in order to determine the risk of cancer in these lesions.

Methods

The authors searched the PubMed database to find relevant studies, then evaluated 602 abstracts, eventually selecting 22 studies that met their criteria for finding thyroid incidentalomas by PET and that also included follow-up, FNA, or surgery. Studies were excluded if they included participants with a history of thyroid disease or were case reports or evaluated fewer than 10 patients.

Results

Twenty studies were retrospective and 2 were prospective; 11 were performed as part of disease follow-up for staging. All were published before 2010. The total number of subjects was 125,754; the number in each of the 22 studies ranged between 477 and 15,711. Focal thyroid uptake was found in 1994 (1.6%); 1051 had follow-up and 1025 had a diagnosis assigned by cytology or histology. The prevalence of focal uptake varied between 0.1% and 4.8% in the various studies. The prevalence of thyroid cancer in these lesions was 36% and varied from 10 to 64% in different reports. There was a similar mean incidence of malignancy in lesions with focal uptake, about 35%, in studies from the United States, Europe, and Asia. The positive predictive value of focal uptake for malignancy was 39%.

Diffuse thyroid uptake was reported in only eight studies and found in 2.1% of subjects; it varied from 0.1 to 4.4% in different reports. The prevalence of cancer varied from 0 to 13.3% (mean, 3.9%) of those with diffuse uptake, but the diagnosis was established by FNA or histology in only 77 patients. Seven studies did not investigate diffuse uptake because previous reports indicated that diffuse uptake usually represented benign disease, such as chronic thyroiditis or Graves' disease.

In 18 studies, standard uptake values (SUVs) were calculated for the focal uptake, but the manner in which this was done differed among various studies. The SUV expresses the intensity of the uptake. For 80 benign lesions, the mean (±SD) SUV was 4.8±3.1 and for 78 malignant lesions it was 6.9±4.7. Although the means differ significantly, there is considerable overlap.

Conclusions

Thyroid nodules found incidentally using 18F-FDG–PET are at relatively high risk of being malignant if uptake is focal.

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ANALYSIS AND COMMENTARY

The authors have carried out an excellent synthesis of the literature on this topic and have clarified the different diagnostic significance for prediction of malignancy when thyroid uptake in a PET study is focal versus diffuse. Diffuse uptake has poor predictive value for malignancy; in contrast focal uptake suggests malignancy in almost 40% of lesions. However, in this retrospective study, only 29% of the lesions with focal uptake were confirmed by surgery. PET scans are often combined with CT in order to verify that there is an anatomic basis for the labeled glucose uptake, and the CT provides valuable information. Focal uptake without a discernible focal anatomic lesion on CT was indicative of a benign lesion with high certainty (2).

In the early days of PET scanning for indeterminate thyroid nodules, it was hoped that calculation of the SUV, a quantitative value for the intensity of focal uptake, would provide a precise cutoff between malignant and benign lesions, but this has failed to materialize. Nevertheless, there is more concern about malignancy when the SUV is high than when it is low. The SUV has also been found to correlate directly with the size of the lesion (3).

This fact that PET scans showing focal uptake in a thyroid nodule predict malignancy should not be used to promote the use of PET, a very expensive method, for making the diagnosis of cancer in a thyroid nodule. In a study from India comparing PET/CT scans with high-resolution ultrasonography in 200 patients with solitary thyroid nodules, the authors concluded that PET/CT did not have a significant advantage over ultrasonography (4).

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