

Application of 18F-Fluorodeoxyglucose Positron Emission Tomography in the Diagnosis of Thyroid Lesions

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18F-Fluorodeoxyglucose antielectron emission pictorial representation (FDGPET) could be a non invasive methodology for screening the complete body for varied varieties of malignancies that show enlarged aldohexose utilization compared with traditional tissues. This system has been urged as Associate in Nursing acceptable tool for medical diagnosis of benign and malignant lesions within the surgical analysis of thyroid nodules cytologically diagnosed as cyst growth [1,3-6]. What is more, this practical imaging technique has shown a crucial role within the detection of incidentally found thyroid lesions. Incidentalomas of the thyroid ar outlined as thyroid lesions known by imaging imaging, like ultrasound (US), computed axial tomography (CT) and resonance imaging (MRI) for nonthyroid illness. The traditional ductless gland is typically not visualised through a FDG-PET scan and therefore the uptake of the FDG in is homogenised and of low intensity. the amount of thyroid incidentalomas known by FDG-PET (PET incidentaloma) is increasing. As per the buildup pattern, PET incidentaloma is classed as diffuse and focal. A diffuse pattern is mostly thought of benign since most cases ar response thyroiditis; on the contrary a focal PET incidentaloma could be a thyroid nodule, like benign nonmalignant tumour or cancer. The most standardized uptake worth (SUVmax) is employed as a semiquantitative indicator of FDG uptake, however SUVmax is influenced by several factors, together with aldohexose transporter expression, viable cell variety, growth intromission and inflammatory cells. The presence of a focal lesion characterised by increase in metabolic activity and by a SUVmax \geq two.5 is very suspicious for malignancy. it's been rumored that focal thyroid PET incidentalomas ar related to a high likelihood of malignancy, starting from regarding half-hour to five hundredth. Te variety of thyroid cancers will increase with age in each men and girls. The aim of this study was to work out the diagnostic accuracy of incidental FDG-PET/CT focal uptake within the thyroid in patients with cancers of nonthyroidal origin, so as to scale back the amount of thyroidectomies performed on nodules that later established to be benign. We have a tendency to examinationined thirty patients World Health Organization underwent to FDG-PET exam for nonthyroid malignities during which focal PET incidentalomas were found. The patients with focal uptake underwent to fine needle aspiration diagnostic assay (FNAB) so as to determinate the biology of the nodule. Indications for thyroid FNAB are: single solid hypoechoic nodule >1 cm, irregular margins, organic process, intranodular and calcifications, sophisticated nodules with mixed echo-structure,

nodules in patient with MEN2, previous history of thyroid cancer or cervical radiation, nodule in maternity patient. FNAB has become the accepted tool to judge thyroid lesions to achieve a lucid diagnoses and an accurate therapeutic strategy. The classes counseled by the Bethesda System are:

- TIR1 non-diagnostic or unsatisfactory: thyroid cysts containing histiocytes, however with very little or no cyst cells, ought to be thought of non-diagnostic and taken as “cyst fluid solely.”
- TIR2 benign: this class includes adenomatoid/hyperplastic nodules, mixture nodules, nodules related to Grave's illness, and inflammation. the danger of malignancy during this cluster of diagnoses is or so 0-3%with a false negative rate between 1-10%.
- TIR3 atypia of undetermined significance (or cyst lesion of undetermined significance): samples into this class ought to contain cells (follicular, lymphoid, others) exhibiting branch of knowledge and/or biological science atypia.
- TIR4 atypia cyst (i.e. architectural) and not cellular, “Follicular Lesion of Undetermined Significance”. the danger for malignancy during this class is or so 5-15%.
- TIR5 suspicious for malignancy: the malignancy thought of most during this class is appendage cancer. different malignancies embody medullary thyroid cancer, lymphoma, and pathologic process malignancies. The risk for malignancy during this class is close to 60-75%.
- TIR6 malignant: this class includes malignancies exhibiting the diagnostic options characteristic of a given malignancy (e.g., appendage cancer, medullary cancer, lymphoma, and pathological process carcinoma). the chance for malignancy is 97- ninety nine .

Surgical intervention is usually recommended for patient diagnosed with appendage cancer. The extent of the surgery, excision or total extirpation, depends on many factors (i.e., size of the lesion, patient's age, sonographic look of the lesion). Subjects and strategies Subjects From January to Sep 2011 a complete of 2510 patients were evaluated at our establishment with whole-body FDG-PET. Thirty patients were known with incidental focal or diffuse uptake in thyroid bed (8 males and twenty two females; mean age, sixty six \pm twelve years). All patients had a previous history of cancer, four carcinoma twenty carcinoma, 4 lymphoma, two carcinoma, and none shown clinical manifestations far-famed of thyroid unwellness like dyspnea, cough, regional pathology, fold disfunction. No subjects are treated with cervical radiation. All patients with focal or diffuse uptake underwent activity of body fluid level of

thyroid stimulating internal secretion (TSH), free T (FT3, FT4), anti-thyropoxidase protein and anti-thyroglobulin protein. once focal uptake was detected within the thyroid, the patients underwent sonography (US), FNAB. strategies All patients fasted for a minimum of half-dozen h before F18-FDG IV injection; body fluid aldohexose level was traditional all told of them. Patients were injected with 370-450 MBq of F18-FDG IV and hydrous (500 mil of IV saline binary compound (NaCl) zero.9%) to cut back pooling of the radiotracer within the kidneys. regarding 600 cc of distinction resolution were administered per os to opacity the enteral loops. The PET-CT scan begins 40-60 minutes once the radiotracer injection.

The PET-CT system Discovery ST16, (GE Medical Systems, TN, USA) was used. This method combines a high-speed immoderate 16-detectorrow (912 detectors per row) CT unit and a positron emission tomography scanner with 10080 Bi germanates (BGO) crystals in twenty four rings. a coffee electrical phenomenon CT scan was noninheritable for attenuation correction of PET pictures (80 mA, 140 kV, field of read (FOV) regarding 420-500 millimetre, CT slice thickness three.75). once non-enhanced CT, total-body PET examination within the caudocranial direction, from higher thighs to vertex, was performed (two bed positions, four min per bed). pictures were reconstructed mistreatment ordered subsets expectation maximization (OS-EM) algorithmic program once 25-30 min of acquisition. Contrast-enhanced CT scan (120-140 kV, automatic milliamperage (limit 330-350 mA), thickness three.750 millimetre (reconstructed at one.25 mm), acquisition mode twenty seven.50/1.375:1, gantry rotation time zero.6 s, large FOV, matrix 512×512] was distributed with IV administration of nonionic halogen medium (100-120 mil, 370 mg/ml, at 2-2.5 ml/s), getting 2 ordered stacks of scans. the primary comprised the higher abdomen with a 30-s delay from the injection onset; the second extended from the neck to the pelvis with a 60-s delay. Region of interest was drawn over the tumors on the thwartwise slice and also the most SUVs (SUVmax) of the thyroid lesions were recorded. The lesions with a SUVmax >2.5 were thought-about positive for the presence of the unwellness in accordance with similar previous studies. FNAB was dead employing a 21-gauge needle and a 10-ml syringe below US steerage with iU22 with a research center frequency of 5-12 cps (Philips). 2 passes were created per nodule. Samples obtained by FNAB were examined by pathologists. The cytological sample in fixative liquid is ready with thin-prep technique and every one aspirates were stained with Papanicolaou staining. The nodules had a diameter enclosed between one and four cm. The interval between one8F-FDG PET and FNAB was a minimum of 1 month. All patients with TIR4-5-6 at biology examination underwent to extirpation. Results PET incidentaloma was discovered in thirty patients (8 males and twenty two females; mean age, sixty six ± twelve years) and SUVmax ranged from two.5 to 20. Thyroid functions were normal in all 30 subjects and there were no

clinical manifestations of thyroid disease. FDG-PET uptake pattern was diffuse in 8 patients (26.7%) and focal in 22 patients (73.3%). The 8 patients with a diffuse uptake of FDG underwent measurement of serum level of thyroid hormones and ultrasonography (US). The final diagnosis was autoimmune thyroiditis. The patients with focal uptake underwent FNAB 4 patients with TIR1 (18.2%), 3 patients with TIR2 (13.6%), 11 patients with TIR3 (50%), 2 patients with TIR4 (9.1%), 1 patient with TIR5 (4.5) and 1 patient with TIR6 (4.5%). All 4 patients with TIR4, TIR5 and TIR6 underwent to thyroidectomy and the final diagnosis was papillary carcinoma. Discussion In recent years the use of FDG-PET/TC for the evaluation of malignant tumors has increased significantly. Consequently it has also increased the incidence of incidentalomas. Thyroid nodules are one of most common endocrine disorders. The risk of malignancy in generalized thyroid swelling is about 3% and in solitary thyroid nodule it is about 15% .

Discussion:

In recent years the use of FDG-PET/TC for the evaluation of malignant tumors has increased significantly. Consequently it has also increased the incidence of incidentalomas. Diagnostic technology used to study thyroid nodules are ultrasonography, CT and MRI, and frequently encounter incidental detection of thyroid nodules during examination of the neck for purposes other than nonthyroidal origin disease. To confirm the etiology of thyroid nodules it is used fine needle aspiration cytology or biopsy with US. Because there is a risk for malignant growth associated with these lesions, appropriate management guidelines and protocols need to be designed to adequately treat patients with focal “incidentalomas” to prevent undertreatment or unnecessary thyroidectomy. In our study a total of 2510 patients were evaluated with wholebody FDG-PET. In 30 Patients incidental focal or diffuse uptake in thyroid bed were identified (8 males and 22 female, mean age, 66 ± 12 years). FDG-PET uptake pattern was diffuse in 8 patients and focal in 22 patients. All patients with diffuse uptake underwent measurement of serum level of thyroid stimulating hormone (TSH), free thyroxine (FT3, FT4), anti-thyropoxidase antibody and anti-thyroglobulin antibody and ultrasound examinations of the thyroid gland that showed benign disease such as thyroiditis and multinodular goiter. The 22 patients with focal uptake underwent ultrasonography (US) and FNAB, 4 of them had respectively 2 TIR4, 1 TIR5 and 1 TIR6 and underwent to thyroidectomy. The final diagnosis was papillary carcinoma. Several studies have reported that focal thyroid PET incidentalomas are associated with a high probability of malignancy. For example, in a study on patients whom underwent a FDG PET examination for cancer of nonthyroidal origin, 102 demonstrated thyroid incidentalomas (2.3%); 15 (21%) patients had thyroid biopsy: 7 (47%) with thyroid cancer, 6 (40%) with nodular hyperplasia, 1 with thyroiditis and 1 with atypical cells of indeterminate origin. Of 102 patients, 71 had a

focal area of increased FDG uptake and 31 patients had marked and diffuse FDG uptake involving the entire thyroid gland. The authors had concluded that a focal uptake of FDG in thyroid incidentaloma indicates a high risk of malignancy. Similarly, in a study on 1,330 subjects whom underwent FDG-PET for metastasis evaluation and cancer screening, had found 29 thyroid FDG-PET incidentaloma: 21 showed a focal uptake of FDG and 8 a diffuse increased FDG uptake. Four of 15 focal incidentalomas (26.7%) were papillary thyroid cancer. A similar study had demonstrated that focal FDG uptake in thyroid nodules correlates with high risk of thyroid malignancy: of 18 patients, 5 had incidental focal FDG-PET/CT uptake in the thyroid gland and on final pathologic findings those were papillary carcinoma. Another study on 1102 patients

demonstrated that diffuse thyroidal FDG uptake may be an indicator of chronic thyroiditis. In a study on 42 patients with cytologically indeterminate thyroid nodules, it was performed a FDG PET which demonstrated that a focal uptake of FDG correlated with a higher risk of malignancy: 11 patients had malignant nodules corresponding to increased focal FDG uptake, 39% of the patients with benign thyroid nodules had no focal ¹⁸F-FDG uptake. This study also demonstrated that the preoperative use of ¹⁸F-FDG PET would result in a significant reduction in the number of thyroidectomies performed in patients with benign lesions: the pre-PET probability of cancer was 26.2% and this probability increased to 36.7% after PET for those patients whose exam showed focal uptake.