

CASE REPORT

One patient with two different 18-fluorodeoxyglucose positron emission tomography/computed tomography views

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Abstract

A normoglycemic patient with a diagnosis of laryngeal cancer underwent F-18 Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography (F-18 FDG PET/CT) for staging purposes and two different results were obtained. In the first assessment, F-18 FDG uptake of the primary lesion was very low, but a significant F-18 FDG uptake was noted in the second evaluation.

F-18 FDG PET/CT is used for the diagnosis, staging and re-staging, as well as for the assessment of response to treatment in oncological patients. F-18 FDG uptake is associated with fasting blood glucose levels and satiety. The lower and upper limit of fasting blood glucose is variable between centers.

In this present case report, we want to discuss the factors responsible for not detecting F-18 FDG uptake in the area of primary lesion in a normoglycemic patient with laryngeal cancer.

Keywords

F-18 FDG, Normoglycemia, Uptake, Insulin

1 Introduction

F-18 Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography (F-18 FDG PET/CT) is a commonly used and highly valuable imaging test used for diagnosis, staging, re-staging and evaluation of response to treatment in patients with oncological diseases ^[1-4]. The degree of F-18 FDG uptake by metabolically active cells may depend on various factors. Besides fasting blood glucose levels, the fasting status of the patient carries importance.

In the literature, the recommended range of fasting blood glucose levels during F-18 FDG PET/CT examination is between 140 and 200mg/dL. It has been reported that the lower the fasting blood glucose level is the more significant is the distribution of FDG. Likewise, fasting duration of the patient is also important. In some centers, it is recommended that patients should fast for 4-6 hours before the test, while some centers recommend 12 hours of fasting ^[5].

2 Case presentation

A vegetative laryngeal mass was detected in the otorhinolaryngological examination of a 64 year old male patient with a complaint of hoarseness. The histopathological report of the biopsy sample taken from the right vocal cord revealed squamous cell carcinoma. F-18 FDG PET/CT examination was requested for staging of the primary tumor.

On the research day, the patient indicated that he had no history of diabetes and he had been fasting for 12 hours.

Before F-18 FDG PET/CT test, the patient's blood glucose level measured using a glucose meter was 74 mg/dL. One hour after injection of 5 mCi (185 Mbq) of F-18 FDG intravenously, a low dose CT scan from vertex to proximal thigh was obtained for anatomic correlation and attenuation correction (Siemens Biograph 20 mCT). Then, PET images were taken from proximal thigh to the vertex at 2 minute/bed position for 5-6 bed positions. When the F-18 FDG PET/CT images were evaluated, it was observed that there was mild diffuse F-18 FDG uptake in the muscles and in the primary lesion (SUVmax 2.1), and there was marked cardiac activity (see Figure 1). When questioned, the patient stated that he had eaten a little bit. A new date was scheduled for the examination and the patient was recommended to fast for 12 hours before coming.

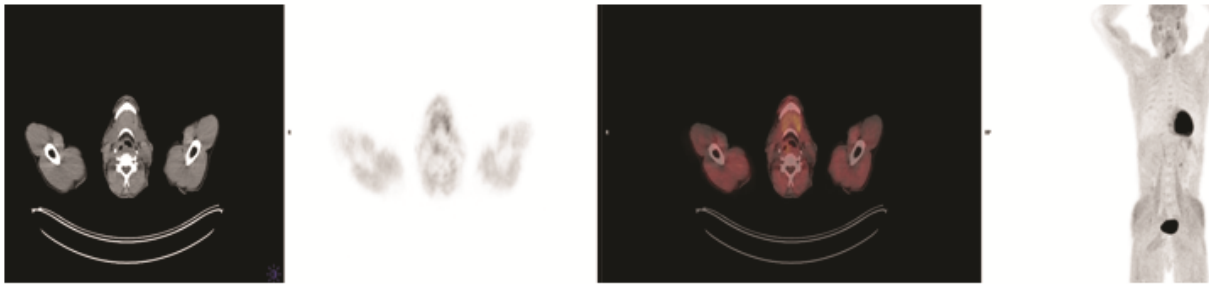


Figure 1. The first scan. F-18 FDG PET/CT image showing F-18 FDG uptake in the muscles and heart; mild FDG uptake was noted in the larynx.

Before the second test, blood glucose level measured with the glucose meter was 77 mg/dL. The patient was given the same dose of F-18 FDG by intravenous injection and a second PET/CT scan was performed using the same protocol. There was a significant F 18 FDG uptake in the primary lesion (SUVmax: 11.4), however, no F-18 FDG uptake was observed in the heart and muscles (see Figure 2).

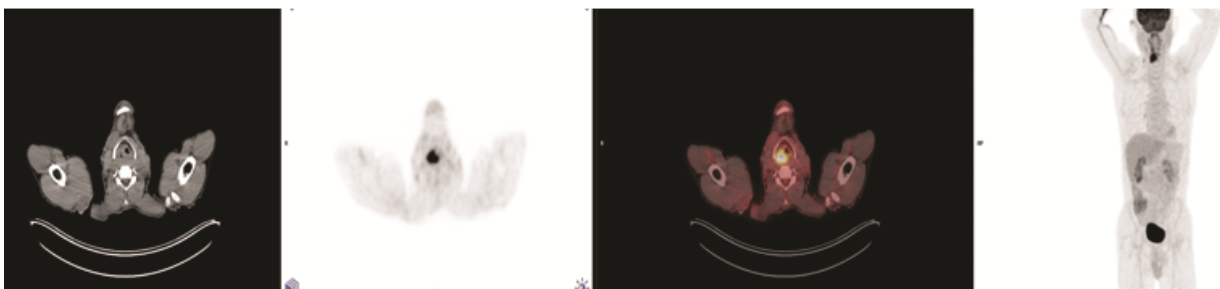


Figure 2. The second scan. F-18 FDG PET/CT image showing F-18 FDG uptake in the larynx.

3 Discussion

The high glucose metabolism of tumor cells in comparison to normal cells is the basis of using F-18-FDG for tumor imaging in PET-CT. Increased glycolysis in tumor cells leads to an increase in the number of glucose transporter proteins

(GLUT), especially GLUT1 and intracellular hexokinase enzyme levels. F-18 FDG, after intravenous administration, uses the same pathways as glucose until a certain step of glucose metabolism. Similar to glucose, F-18 FDG is transported into the tumor cell by insulin dependent GLUT1, and phosphorylated into F-18 FDG-6P by hexokinase enzyme. As F-18 FDG-6P, is not a suitable substrate for glucose-6 phosphate-isomerase, it does not enter the other metabolic reactions of glycolysis, and continues to accumulate in tumor cells as long as it is transported^[4,6].

The physiological distribution of F-18 FDG in the body is variable due to different GLUT contents of the tissues. GLUT2 is expressed in the liver and pancreas, whereas GLUT4 is found in the skeletal muscle, heart and adipose tissue^[7]. In addition, 18 FDG uptake may widely vary depending on exercise, hunger, satiety, fasting blood glucose levels and insulin use^[8-10]. In addition to patients with high fasting blood glucose levels and those who have eaten food before the examination, F-18 FDG activity is increased in the muscles and heart of patients using insulin^[4,10].

It was reported that there was no difference in the liver, muscle and brain SUV values of diabetic patients receiving or not receiving short-acting insulin^[11].

In the case presented herein, although there was significant F-18 FDG uptake in the heart and muscle tissue, F-18 FDG uptake was very mild in the primary lesion in the first examination. However, in the repeated scan after prolonged fasting, while there was no FDG uptake in the heart and skeletal muscle, there was significant FDG uptake in the primary lesion. The FDG uptake in the heart and muscles was attributed to the increased postprandial endogenous insulin levels as the blood sugar of our patient was within normal ranges. However, we cannot confirm this situation, as we did not assess the insulin levels of our patient.

F-18 FDG PET/CT tests are often used to assess response to treatment and restaging in oncological cases^[4], and scans are obtained according to guidelines on the quality and technique of scanning and patient preparation^[5].

In these cases, all PET/CT scans should be performed under the same conditions as the first PET/CT (same fasting period and the same dose)^[5,12]. The differences in the pre-test preparation may lead to differences in FDG uptake of the lesion, and regression of a lesion may be interpreted as progression and vice versa.

We suggest that assessment of only fasting blood glucose levels is not sufficient in patients undergoing F-18 FDG PET/CT, and insulin (insulin peptide C) levels should also be assessed.

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