

PET/CT Results Mimicking Malignancy: Tissue Diagnosis May Change Treatment: Case Report

Maligniteyi Taklit Eden PET/BT Sonuçları: Doku Tanısı Tedaviyi Değiştirebilir

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ABSTRACT Positron emission tomography (PET) has become an important tool in terms of staging, treatment planning and follow-up of head and neck cancers. Although PET is reliable for the cancer patients, increased 18 F-fluorodeoxyglucose (18-FDG) uptake can be seen in normal tissues such as muscle, fat and brain in addition to inflammatory and granulomatous process. The use of combined PET and computed tomography (CT) may overcome these encountered difficulties with the help of the fusion of anatomical and physiological data. Despite the use of fusion imaging, the radiological findings seen in some disease process continue to cause serious problems. In this study, we present a patient with stage 1 nasopharynx cancer who had unexpected 18-FDG uptake within mediastinal lymph nodes in his control PET/CT imaging obtained after treatment. We review the literature regarding false positivity reasons of PET/CT and emphasize the importance of tissue diagnosis.

Key Words: False positive reactions; mediastinal neoplasms; nasopharyngeal neoplasms; positron-emission tomography

ÖZET Pozitron emisyon tomografisi (PET), baş boyun kanserlerinin evreleme, tedavi planlaması ve takibinde önemli bir tanı aracı konumuna gelmiştir. PET kanserli hastalar için güvenilir olmakla beraber, artmış 18 F-fluorodeoksiglukoz (18-FDG) tutulumu kas, yağ ve beyin gibi normal dokularda, ek olarak inflamatuvar, granülatöz hastalıklarda da izlenebilir. Kombine PET ve bilgisayarlı tomografi (BT) kullanımı, anatomik ve fizyolojik verilerin füzyonu yardımı ile, karşılaşılan bu zorlukların üstesinden gelebilmektedir. Buna rağmen; bazı hastalık süreçlerinde görülen radyolojik bulgular, füzyon kullanılmasına rağmen karışmaya devam etmektedir. Evre 1 nazofarinks kanseri tanısı ile tedavi ettiğimiz, tedavi sonucunda tam yanıt alınan ancak yanıt değerlendirmesi amacı ile yapılan PET/BT’inde; mediasten lenf nodlarında yaygın FDG tutulumu ile karşılaştığımız olgumuz üzerinden PET/BT’de karşılaşılan yanlış pozitif sonuçları ve bunun yanı sıra doku tanısının önemi vurgulamayı amaçladık.

Anahtar Kelimeler: Yanlış pozitif reaksiyonlar; mediastinal tümörler; nazofaringeal tümörler; pozitron emisyon tomografi

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1 8-FDG positron emission tomography (PET) is used with increased frequency in evaluation and staging for the patients with head and neck masses.^{1,2} Although PET demonstrates the metabolic activity increase in malignant tissues, it may cause some errors due to lack of data for anatomic location. The absence of spatial resolution can make predisposition to false positive comments due to the different physiological uptake areas in the head and neck masses. The combined use of PET/CT is impor-

tant for all kind of cancer types in terms of giving advanced anatomical data, providing a better evaluation of neoplastic and non-neoplastic tissues.³ Despite all technological developments, false positive results are commonly seen in PET/CT. Granulomatous reactions are one of the common causes which mimics neoplastic tissue regarding FDG uptake. Several reactions and diseases can cause misleading results by showing neoplastic level of FDG uptake. Accurate lymph node and treatment response evaluation is critical in determining the further treatment. False positive results originating from benign processes may cause important problems in terms of taking decision for the patients' follow-up period. In such cases, physicians must be careful and invasive tissue diagnosis must be done if there is any suspect.

CASE REPORT

A 32-years-old patient complaining about nasal congestion and headache was examined and malignant mass located within nasopharynx wall was detected. PET/CT imaging was performed for staging and also treatment planning. It was seen that 28 mm diameter mass with the level of malignancy FDG uptake (SUV max: 14,9) was located to nasopharynx. The mass was staged as T1N0M0 by using American Joint of Cancer Committee guideline. Endoscopic biopsy was done and non-keratinized squamous cell carcinoma was reported in pathological result. Radiotherapy and concomitant cisplatin chemotherapy was planned. Curative conformal radiotherapy was given with 2 Gy fraction per day to total dose of 70 Gy. Control evaluation was done with PET/CT after 3 months from treatment. Diffuse, bilateral mediastinal lymph node with pathologic FDG uptake (SUV max: 9,5-11,6) were seen in his control PET/CT imaging (Figure 1, 2). The patient was discussed in our Council of Thoracic Oncology. Mediastinoscopic evaluation of those lymph nodes was decided to carry out in the department of thoracic surgery. The biopsy report taken from suspicious lymph node was compatible with granulomatous lymphadenitis without any metastatic evidence. Blocs and preparations were also evaluated for sarcoido-

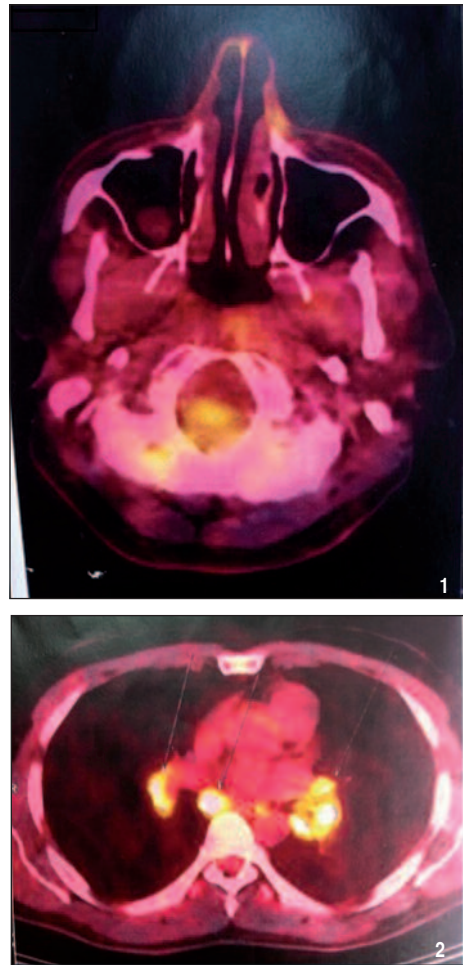


FIGURE 1,2: Control PET/CT images of patient showing characteristic FDG uptake in mediastinal lymph nodes and the complete response of primary area.

(See color figure at

<http://www.turkiyeklinikleri.com/journal/journal-of-medical-research-case-reports/1300-0284/>)

sis and tuberculosis but there could not be shown any sign of them. Four years follow up of the patient was without any distant metastasis and local recurrences.

LITERATURE REVIEW AND DISCUSSION

PET/CT is one of the non-invasive imaging techniques which have achieved increased application area for cancer such as staging, detecting treatment effectiveness, re-staging after treatment and also diagnosis of occult malignancies.¹⁻³ Metabolic abnormalities detected with PET imaging can be localized with concomitant CT imaging fusion. FDG is the most commonly used tracer in PET im-

aging. PET scans the FDG molecules confined in cells due to the increased glucose metabolism in malign lesions. After scanning period, semi-quantitative analysis is used for giving objective result. Standard uptake value (SUV) is used for so-called semi-quantitative analysis. It represents the ratio of the actual radioactivity concentration found in a selected part of the body at a certain time point and the radioactivity concentration in the hypothetical case of an even distribution of the injected radioactivity across the whole body.

It is reported in literature that FDG PET is more specific than conventional techniques for detecting the most residual or recurrent nodal metastasis of head and neck tumors. In those articles, the sensitivity is given 67-100% and spesifity is given 77-100%.⁴⁻⁸ Furthermore integrated PET/CT imaging gives better results.⁴⁻⁶ Integrated PET/CT imaging is the preferred technique in order to evaluate the treatment response and follow-up for nasopharyngeal carcinoma.⁹ While there is not any FDG involvement in cervical lymph nodes and primary disease area, mediastinal lymph node involvement is seen so rare in nasopharyngeal carcinoma. Nevertheless we must rule out the lymph node metastasis of primary disease for the patients with malignity diagnosis.

The efficiency of PET/CT in mediastinal lymph nodes was evaluated in the patients with non-small cell lung cancer elaborately. The data is limited in terms of verifying PET/CT results with mediastinoscopy. Patient based study of Takamochi et al was found 14% false positivity rate and 20% false negativity rate for non-small cell lung cancer with PET/CT.¹⁰ Additionally, the lymph node level of 5, 6 and 7 were given the stations showing the highest false positivity rates. There was FDG involvement with malignity level in above-mentioned lymph node stations in our patient. Phicians must be careful in this kind of FDG involvement especially in the countries having high rates for granulomatous disease such as tuberculosis.

FDG is not only a cancer detection tracer; false positive results are commonly seen with benign diseases. It is cited that false positivity is seen with

the rate of 13% and false negativity with 9% in literature.¹¹⁻¹³ Inflammatory cells (neutrophil and activated macrophages) demonstrate increased FDG uptake in inflammatory or infection areas.¹² If the false positivity activity areas are not detected correctly, this may bring important morbidity and mortality potential with it.

It is known that brown adipose tissue is seen in 2-4% of patients especially women and children in cold weather. This tissue is responsible for the thermogenesis induced by cold and diet. Mitochondria in brown adipose tissue express the thermogenic protein and FDG uptake takes place in these structures.¹⁴ FDG is taken into brown adipose tissue of neck, paraspinal area and also pararenal space.

A large number of non-specific inflammatory/infectious processes may cause false positive diagnosis and results in terms of malignancy in PET/CT by uptaking increased FDG. False positive results were reported in various conditions such as abscess (brain, abdomen, kidney, tuboovarian areas), osteomyelitis, sinusitis, dermatitis, oesophagitis and gastritis.¹² Pneumonia is another defined etiologic reason. Tuberculosis and fungal infections (criptoccosis, coccidiomycosis, blastomycosis and aspergillosis) are shown to be the most commonly seen reasons of false positivity in PET/CT evaluations.¹⁵

Plenty of non-infectious inflammatory granulomatous process cause increased metabolism. Localized and diffuse inflammatory changes trigger false positive PET/CT imaging as a result of this. Sarcoidosis, atherosclerosis and pneumoconiosis are the most common conditions regarding this issue.

False positive PET/CT imaging results can be seen in most iatrogenic conditions due to increased metabolic activity. Insulin administration before FDG injection can cause diffuse FDG uptake in muscles.¹⁵ Increased FDG uptake is seen in bones after CSF (Colony Stimulating Factor) injections.¹⁶ Postsurgical changes such as previous biopsies, catheter implantation sites and areas of drainage tubes placed can cause increased FDG uptake.¹⁷ Uptakes due to iatrogenic facts include postradiotherapy pneumonia/fibrosis and talk pleurodesis.

Acute or chronic inflammation, abscess, inflammatory lymphadenopathy and nonspecific reactions can mimic malignancy process in PET imaging.^{13,18}

It should be kept in mind that some benign tumors show increased FDG uptake as high as malignant ones. These cases include fibrous mesothelioma, schwannoma, aggressive neurofibroma and enchondroma. It is suggested that history of patient and correlation of other imaging protocols may be necessary. The most important thing is long-term, slow and continuous uptake characteristics of the lesion. Biopsies or resections may be necessary in order to prevent false diagnosis.^{7,8,16,19-21}

Metabolic activity detected in mediastinum was not compatible with the clinical findings of our presented patient in terms of pre-treatment stage

and response of primary tumor. Therefore multidisciplinary approach was preferred for deciding next step of patient's treatment. The patient was evaluated by multidisciplinary Thoracic Oncology Council and mediastinoscopy was suggested. The patient was prevented from serious chemotherapy and advanced treatment protocols by the help of pathohistological diagnosis.

Nowadays the use of PET/CT is very important in terms of staging, treatment planning, and evaluation of treatment response. On the other hand, it should be kept in mind that false positive and false negative results can be seen. Multidisciplinary evaluation should be considered for such suspicious metabolic activity. Pathohistological diagnosis is required for distinguishing the lesion mimicking cancer from real malignancy.

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