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Contribution of FDG PET/CT in thorax and mediastinal masses in patients with extrathoracic malignancies

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Abstract

Aim: In patients with known extrathoracic malignancy, the differential diagnosis of thorax and mediastinal masses or pleural fluid detected on FDG PET-CT (F18-Flourodeoxyglucose Positron Emission Tomography-Computed Tomography) examinations as primary tumor metastasis or secondary malignancy is of clinical importance. In this study, the contribution of FDG PET-CT examination in differential diagnosis was investigated.

Materials and Methods: FDG PET-CT examinations of the patients with suspected thorax and mediastinal masses were retrospectively analyzed. The pathology results were considered gold standard.

Results: According to this retrospective analysis breast carcinoma was the most common diagnosis in these patient group with the diagnosis of extrathoracic malignancy.

Conclusion: In case of thorax masses in a patient with extrathoracic malignancy the pathology might be secondary malignancy thus consideration is warranted.

Keywords**:** *thorax, mediastinum, mass, FDG, PET/CT.*

Introduction

FDG PET-CT imaging is very useful in detection, staging, re-staging and monitoring therapy in various tumors. The lung is one of the most common sites of metastases. Discrimination of primary lung ca,second malignancy versus lung metastases is essential, especially in patients with known extratorasic primary cancer, for choosing the appropriate treatment approach and assessing prognosis. Maximum standardized uptake value (SUVmax) is a semiquantitative parameters that reflect metabolic activity, but is not specific markers of malignancies. Positron emission tomography/computed tomography (PET/CT) by using FDG, improves the diagnostic accuracy in the differentiation of benign from malignant lesions in various cancer patients. However, the discrimination of malign or metastatic lung or mediastinal lesions is especially essential in various cancer patients. In patients with known extrathoracic malignancy, the differential diagnosis of thorax and mediastinal

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masses or pleural fluid detected on FDG PET-CT examinations as primary tumor metastasis or secondary malignancy is of clinical importance. In this retrospective study, the contribution of FDG PET-CT examination in differential diagnosis was investigated.

Materials and Methods

Data of 2639 patients who underwent FDG PET-CT examination in our department between December 2022 and May 2023 were reviewed. All patients underwent PET/ CT examinations for staging, restaging, and detection of suspected recurrence. A total of 95 patients with non-pulmonary primary cancer, (38 males (M) and 57 females (F)), were selected who had pathologically proven thorax and mediastinum malignancy. The patient's pathology results and SUVmax values were examined.

Imaging protocol

All patients fasted for at least 4-6 h before FDG injection. PET/CT scans were obtained 60 min after injection using an integrated scanner (Siemens, Biograph True Point 6 PET/CT, Germany). A whole-body CT scan was performed without intravenous contrast administration with 130 kV, 50 mAs, a pitch of 1.5, a section thickness of 5 mm, and a field of view of 70 cm. A PET scan was performed immediately after an unenhanced CT scan, and acquired from the skull base to the upper thigh with a 2-min acquisition per bed position using a three-dimensional acquisition mode. PET/CT images were qualitatively evaluated and assessed in consensus by two nuclear medicine physicians (readers A, B with more than 10 years of experience) on PET/CT. PET/CT images were viewed in the coronal, axial, and sagittal sections. Maximum standart uptake value (SUVmax) of torasic lesions were calculated on PET/CT by using Region of interest (ROI) included at least two-thirds of the lesions. Partial volume effect was minimized by this way. The regions were drawn by generating sphere circles. The quantitative uptake values of FDG (SUVmax) in the lesions ROIs were semiautomatically calculated using workstations (Siemens). Histopathology and follow-up information after PET/CT scanning served as the standard of reference. For final assessment, the standards of references for lesions were based on biopsy.

Results

All 95 patients had histopathologically proven primary extrathorasic malignancies. The most common malignancy was breast cancer. The primary diagnosis of the patients were breast cancer in 24 patients, colorectal cancer in 14 patients, urinary system malignancy in 13 patients, gynecological malignancies in 13 patients, laryngeal cancer in 4 patients, malignant melanoma in 3 patients, stomach cancer in 3 patients, prostate cancer in 3 patients, and other hematological and oncological malignancies in 18 patients. The diagnosis was made by pleural fluid examination in 20 of 95 patients. Primary malignancy metastases were detected in 12 of the patients in this group. SCLC (Small Cell Lung Cancer) was diagnosed in 1 patient with a known diagnosis of chronic myeloid leukemia. No distinction could be made in 7 patients. In the remaining 75 patients, diagnosis was made by mass/mediastinal lymph node biopsy. Metastatic disease was detected in 48 of the patients in this group, lung SCC in 13, lung adenocarcinoma in 11 patients, SCLC in 1 patient, malignant mesothelioma in 1 patient, and lung NET (Neuroendocrine tumor) in 1 patient. Figure 1 and 2 demonstrates

two patients with lung nodules. The distribution of the numbers and rates of patients diagnosed with metastatic disease and lung malignancy according to the primary diagnosis of these patients is given in Table 1.

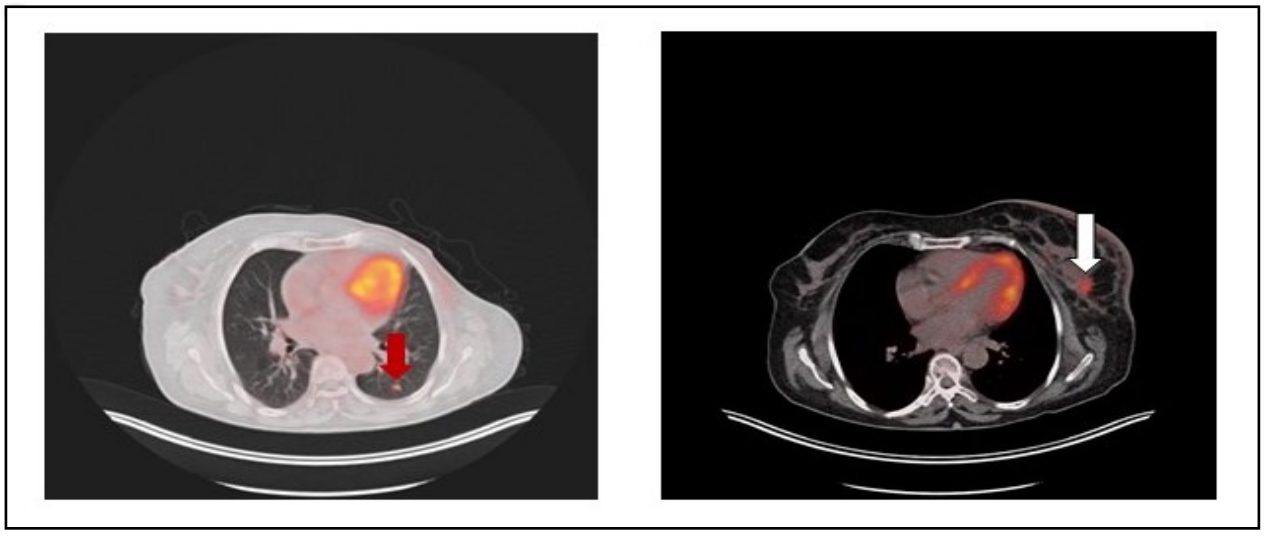

Figure 1: Metastatic nodule detected in the lung parenchyma in a patient with a known history of breast cancer. Left breast primary malignancy is shown with white arrow and left lung metastatic nodule with red arrow in axial images.

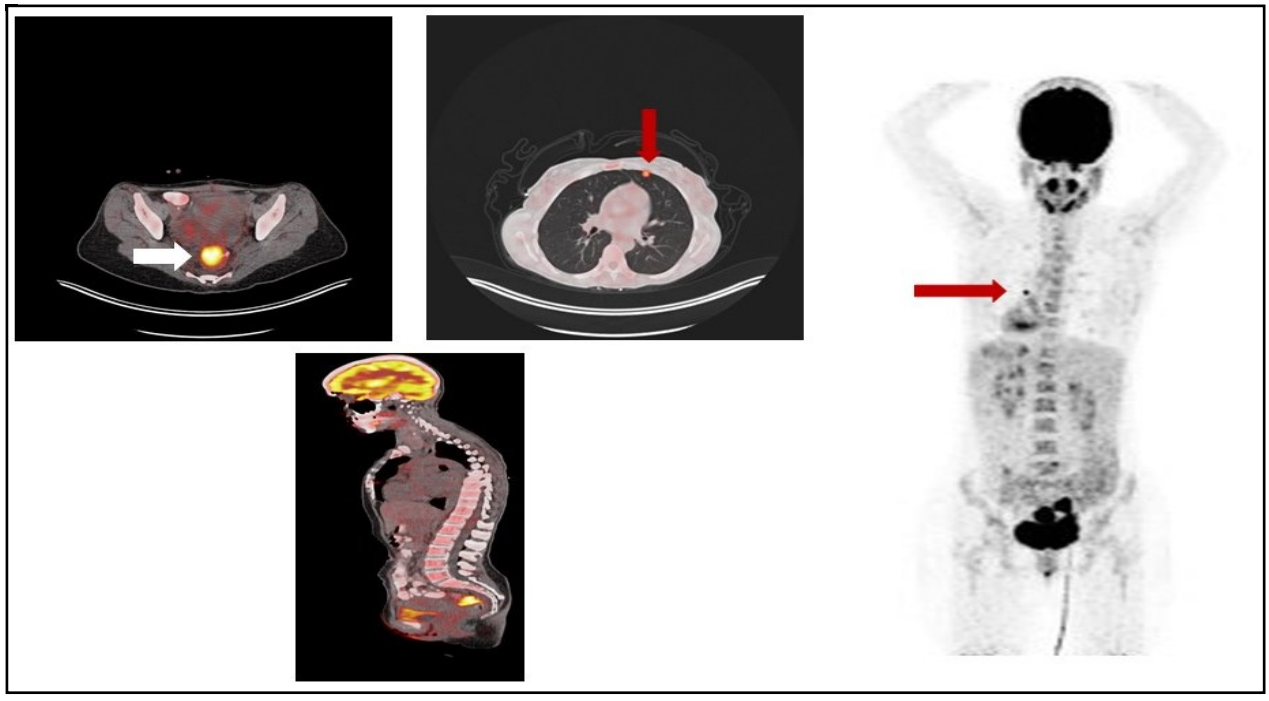

Figure 2: Metastatic nodule detected in the lung parenchyma in a patient with a known history of colorectal cancer. Primary rectal carcinoma is demonstrated with White arrow and metastatic lung nodule with red arrow in axial and MIP (maximum intensity projection) images.

Table 1: Distribution of Patients Who Had Mass/Mediastinal Lymph Node Biopsy

PRİMARY DIAGNOSIS	METASTATIC	LUNG CA	TOTAL
Breast Ca	13 (%81)	3 (%19)	16
Kolorectal Ca	9 (%64)	5 (%36)	14
Urinary system malignancy	6 (%55)	5 (%45)	11
Gynecologic malignancy	6 (%86)	1 (%14)	7
Laringeal Ca	3 (%75)	1 (%25)	4
Malign melanoma	2 (%67)	1 (%33)	3
Stomach Ca	-	1 (%100)	1
Prostate Ca	2 (%67)	1 (%33)	3
Hematologic-oncologic malignities	7 (%44)	9 (%56)	16
TOTAL	48 (%64)	27(%36)	75

Discussion

The lungs are the most common site of metastatic disease in many primary malignancies such as osteogenic and soft tissue sarcoma, germ cell tumors, colorectal cancer, head and neck cancers, malignant melanoma and renal cell carcinoma (1). In our own study, it was observed that the majority of our current patient group consisted of patients diagnosed with breast and colorectal carcinoma.

While isolated lung metastases develop in 10-20% of all breast cancer patients, 60-74% of patients who die due to breast cancer have lung metastases (2,3). According to similar studies in the literature, the rate of metastatic lesions when lung nodules are detected in breast cancer patients is 34.2-75%; It was determined that the primary lung cancer rate was 11.5-48.1% and the benign lesion rate was 13.5-17.7%. In our study, in 16 patients who were diagnosed with breast cancer, whose PET/CT examination revealed malignant FDG uptake in the lungs, and whose involvement was proven to be malignant by pathological diagnosis; We found the metastasis rate to be 81% and the primary lung cancer rate to be 19% (4,5)

Data taken from the literature in patients diagnosed with colorectal cancer; It is estimated that lung metastasis develops at a rate of 10-12% (6). In our study, the pathological data of 14 patients diagnosed with colorectal carcinoma and with malignant involvement in the mediastinum and lung on FDG PET/CT imaging were examined. It was observed that the colorectal carcinoma metastasis rate was 64% and the primary lung cancer rate was 36%.

In patients with known malignancy outside the thorax and mediastinum, FDG PET-CT examination provides limited information in terms of differentiating metastatic disease or secondary lung malignancy in cases where a thorax-mediastinum mass or pleural effusion is detected. However, it has been noted that more metastases were detected in patients with breast cancer, colorectal cancer, urinary system malignancy or gynecological malignancy who underwent FDG PET CT examination. Although lung involvement detected on FDG PET/CT poses a diagnostic challenge, the distinction between lung metastasis and primary lung cancer is the basis for guiding patient management (7-11). Additional false positive causes due to inflammatory and infectious diseases in especially certain regions should be considered as well as other malignancies (12). Additionally FDG PET-CT might be considered for biopsy localization during biopsy procedures for thoracic masses (13).

Conclusion

Mediastinal and lung involvement is a frequently encountered finding on FDG PET/CT scan in patients followed up with extrathoracic malignancy. In patients where histopathological sampling cannot be performed and in patient groups in which treatment needs to be started quickly, the thorax-mediastinum masses can be considered to be metastatic and the treatment process can be accelerated, and more detailed interpretation can be considered during the evaluation of treatment response.

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Authorship Contributions

Concept: A.G., P.P.O., Z.P.K., G.Y., **Design:** A.G., P.P.O., Z.P.K., G.Y., **Supervision:** A.G., P.P.O., Z.P.K., G.Y., M.S., E.A., **Data Collection and/or Processing:** A.G., P.P.O., Z.P.K., G.Y., M.S., E.A., **Analysis and/or Interpretation:** A.G., P.P.O., Z.P.K., G.Y., M.S., E.A., **Literature Review:** A.G., G.Y., **Writer:** A.G.

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