Tumor Thrombus in Inferior Vena Cava from Renal Cell Carcinoma Showing F-18 FDG Uptake on Positron Emission Tomography

Pozitron Emisyon Tomografisinde İnferior Vena Kava İçerisinde F-18 FDG Tutultumu Gösteren Renal Hücreli Karsinom Kökenli Tümör Trombüsü

**ABSTRACT** A 40 year old female was admitted to our hospital with the complaints of weight loss, right-sided flank pain and hematuria. Computed tomography (CT) and magnetic resonance imaging (MRI) studies revealed a mass lesion in the right kidney and thrombus in inferior vena cava (IVC) extending to the right atrium. A whole body Fluorine-18 fluorodeoxyglucose (F-18 FDG) positron emission tomography (PET)/CT (F-18 FDG-PET/CT) showed intense F-18 FDG uptake in the right renal mass and thrombus in the IVC extending to the right atrium. The patient underwent right nephrectomy. Histology and immunohistochemistry of the mass in the right kidney and the biopsy material from the thrombus in IVC revealed renal cell carcinoma (RCC).

**Key Words:** Renal cell carcinoma, positron-emission tomography

**ÖZET** Kırk yaşında bayan hasta kilo kaybı, sağ yan ağrısı ve hematüri yakın malleriyle hastaneye başvurdu. Bilgisayarlı Tomografi (BT) ve Manyetik Rezonans Görüntüleme (MRG) çalışmaları sağ böbrekte bir kitle ve inferior vena kavada sağ atrium içerisinde uzanan trombus açığa çıkardı. Tüm vücut Fluorine-18 fluorodeoksi-glukoz (F-18 FDG) pozitron emisyon tomografisi (PET)/BT (F-18 FDG-PET/CT) taraması sağ renal kitlede ve inferior vena kavada (IVK) sağ atriuma uzanan tümör trombusunda yoğun F-18 FDG tutulumu gösterdi. Hastaya sağ nefrektomi uygulandı. Sağ böbrekten kitle ile IVK içerisindeki trombusun alınan biyopsi materyalinin histoloji ve immünohistokimyası renal hücreli karsinom olarak geldi.

**Anahtar Kelimeler:** Renal hücreli karsinom, pozitron-emisyon tomografisi


It is well known that renal cell carcinoma (RCC) can invade the inferior vena cava (IVC) by extension of tumor thrombus along the renal vein and in some cases extend further as far as the right atrium. Although conventional imaging modalities are being used effectively in the detection of tumor thrombus from RCC, F-18 FDG PET scan also shows vascular invasion due to RCC accurately by providing additional information about the malignant nature of the thrombus.

**CASE REPORT**

The patient is a forty years old female suffering from weakness, weight loss, right-sided flank pain and hematuria for two months. Tenderness in the
right flank region and hepatomegaly was detected on physical examination. An abdominal MRI examination was performed which showed increased signal detection at thrombus in IVC with peripheral contrast enhancement and a right renal mass (Figure 1). The patient also underwent CT scan with iv contrast and a filling defect in IVC extending to the right atrium, which was strongly suggestive of tumor thrombus was detected (Figure 2). We performed a F-18 FDG-PET/CT scan in order to make metabolic characterization of the right renal mass together with the thrombus in IVC. After ten hours of fasting and having serum glucose 110 mg/dl, the patient was injected with 481 MBq (13 mCi) of 18F-FDG intravenously. After 55 minutes of waiting in a semireclined relaxed chair, the patient was imaged using an integrated PET/CT scanner which consisted of a full-ring HI-REZ LSO PET and a 6-slice CT (Siemens Biograph 6, Chicago, USA). The CT portion of the study was done without an iv contrast medium, just for defining anatomical landmarks and making attenuation correction on PET images. F-18 FDG-PET/CT study showed intense FDG uptake in tumor thrombus in IVC extending into right atrium and moderate FDG uptake in circular fashion in the right renal mass (Figure 3). The patient underwent right nephrectomy and biopsy was obtained from tumor thrombus in the IVC. The histopathology of the mass from the right kidney and thrombus in the IVC revealed RCC (Figure 4).

**DISCUSSION**

RCC has a propensity to invade IVC occurring in 4% to 10% of all patients with renal cell carcinoma. Among these patients, 2%–16% have tumors extending into the right atrium. Distinguishing tumor thrombi from the bland cancer-related venous thrombi is important because this complication has significant therapeutic and prognostic implications. Diagnosis of tumor thrombus can alter the management plan and prevent unnecessary long-term anti-coagulation treatment because of wrong diagnosis of bland clot. In case these patients are not treated properly they have poor survival rates. It has been reported that after total resection of this tumor, the 5-year survival rates
range between 40% and 69% when no distant metastases are present.\(^1\)\(^-\)\(^3\)\(^8\) CT, MRI and ultrasound are the current modalities used for the primary detection and evaluation of extension of tumor thrombus from RCC. In a study, multidetector CT (MDCT) thrombus detection sensitivity and specificity was reported as 93% and 80% and MRI sensitivity and specificity was 85-100% and 75% respectively.\(^9\) FLASH-enhanced MRI images provides more accurate assessment of the nature of thrombus (neoplastic or bland) with sensitivity and specificity of 89% and 96% respectively.\(^10\) MRI has an advantage over MDCT in thrombus detection, delineating the superior margin of the thrombus and staging of RCC because of its ability to have a free imaging plane with an optimal spatial resolution in the sagittal and coronal planes. Also, it has intrinsic contrast superiority to CT and can differentiate tumor thrombus from blood without contrast medium.\(^11\) The efficacy of F-18 FDG-PET/CT in the detection of vascular invasion has been reported for several tumors other than renal cell cancer such as thyroid, middle bile duct, hepatocellular, pancreas, vesical, colon, lung cancer and osteosarcoma.\(^12\)\(^-\)\(^19\) F-18 FDG-PET/CT is mostly used for restaging purposes in the evaluation of RCC. It is not advised to use it for staging since urinary excretion of the FDG may obscure the lesions. It has a sensitivity and specificity of 64% and 100% for staging\(^20\) and 71% and 75% for restaging\(^21\) respectively. There are 6 cases reported up to now in which F-18 FDG-PET/CT detected malignant tumor thrombus from RCC.\(^6\)\(^,\)\(^22\)\(^-\)\(^26\) Patients may benefit from F-18 FDG-PET/CT when other conventional imaging modalities are inconclusive.
F-18 FDG-PET/CT is helpful in discriminating between benign and malignant thrombus but interpretation should be made carefully since the benign lesions like inflammatory and infectious venous processes might complicate the cases by showing F-18 FDG uptake.

REFERENCES


CONCLUSION

F-18 FDG-PET/CT imaging is highly sensitive in detection of tumor thrombus from RCC and it can also be used effectively for revealing the malignant nature of the thrombus.