



# <sup>18</sup>F-Sodium Fluoride (NaF) Uptake in Calcified Bladder Carcinoma: Double Density Sign

Kalsifiye Mesane Karsinomunda <sup>18</sup>F-Sodyum Florür (NaF) Tutulumu: Çift Yoğunluk İşareti

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## Abstract

<sup>18</sup>F-Sodium fluoride (NaF) is primarily a skeletal imaging agent which can be localized in extrasosseous calcified foci. Here, we describe a case of a 48-year-old man with bladder carcinoma referred for staging using <sup>18</sup>F-NaF positron emission tomography/computed tomography (PET/CT). <sup>18</sup>F-NaF PET/CT detected a calcified soft tissue mass in the urinary bladder. Extrasosseous <sup>18</sup>F-NaF uptake is often encountered and these non-osseous findings could possibly provide important diagnostic information. Thus, recognition of extrasosseous <sup>18</sup>F-NaF activity has implications for accurate staging and management.

**Keywords:** <sup>18</sup>F-NaF PET/CT, bladder carcinoma, extrasosseous uptake, metastasis

## Öz

Öncelikle bir iskelet sistemi görüntüleme ajanı olan <sup>18</sup>F-Sodyum Florür (NaF) ekstraosseöz kalsifiye odaklarda da tutulum gösterebilir. Burada, <sup>18</sup>F-NaF pozitron emisyon tomografisi/bilgisayarlı tomografi (PET/BT) kullanılarak evreleme için sevk edilen mesane karsinomu tanılı 48 yaşında bir erkek olgu sunulmuştur. <sup>18</sup>F-NaF PET/BT ile, idrar kesesinde kalsifiye yumuşak doku kitlesi tespit edilmiştir. Ekstraosseöz <sup>18</sup>F-NaF tutulumuna sıklıkla rastlanır ve bu kemik dışı bulgular önemli tanısal bilgiler sağlayabilir. Bu nedenle, ekstraosseöz <sup>18</sup>F-NaF aktivitesinin tanınmasının doğru evreleme ve tedavi açısından önemli etkileri vardır.

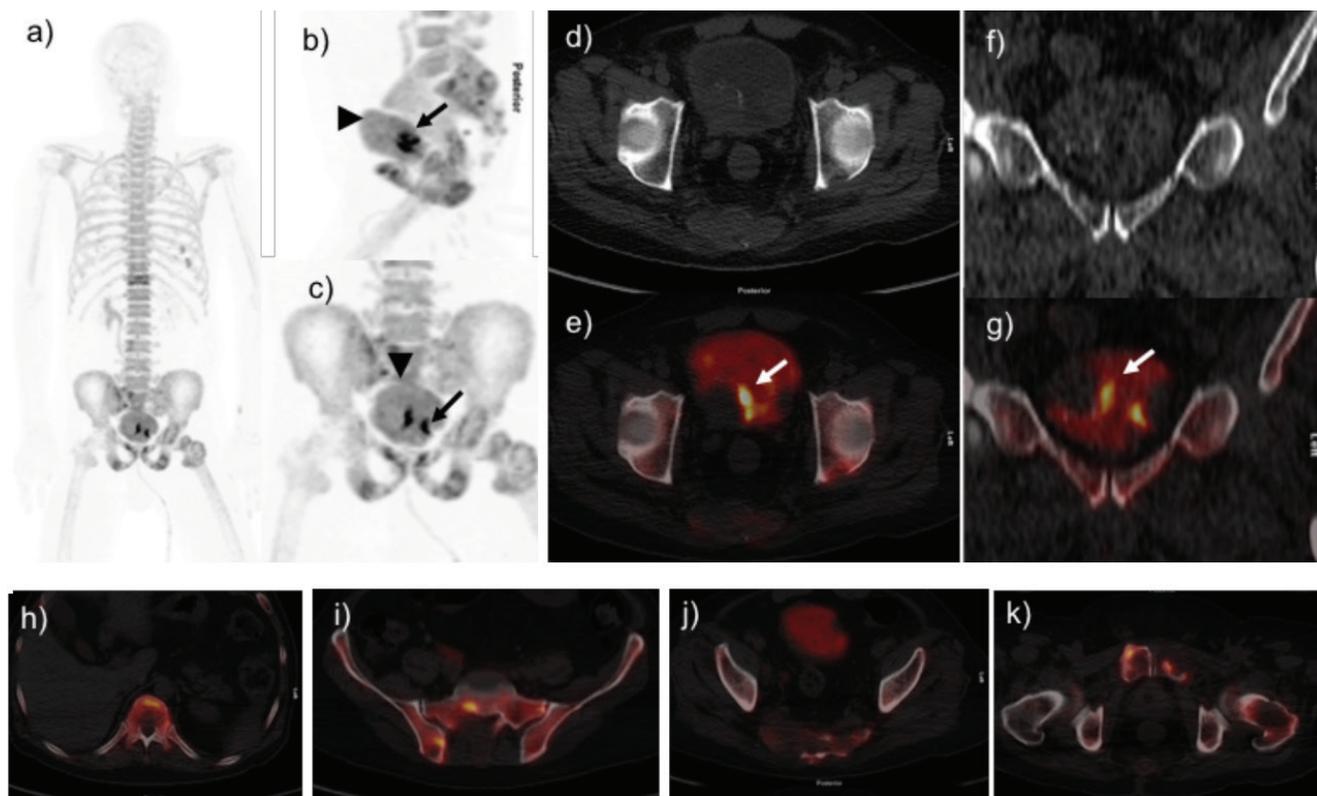
**Anahtar Kelimeler:** <sup>18</sup>F-NaF PET/BT, mesane karsinomu, ekstraosseöz tutulum, metastaz

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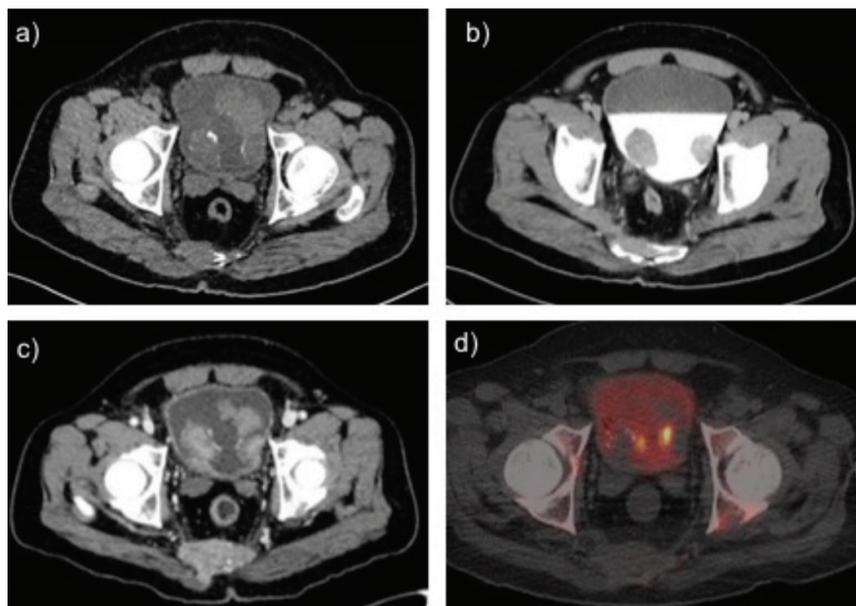
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**Figure 1.** The profile of a 48-year-old man with bladder carcinoma.  $^{18}\text{F}$ -Sodium fluoride (NaF) positron emission tomography/computed tomography (PET/CT) is performed after injecting 3.9 mCi of  $^{18}\text{F}$ -NaF with urinary catheter in place and images are acquired 60 minutes post-injection. a)  $^{18}\text{F}$ -NaF maximum intensity projection (MIP), b) zoom lateral and, c) anterior  $^{18}\text{F}$ -NaF MIP images show two foci of intense activity in the urinary bladder (arrow) and rest of the urinary bladder is filled with mild homogenous tracer uptake (arrow head), findings appear as a double density of increase uptake in the urinary bladder. d, e, f) Non-contrast CT image in the bone window demonstrates soft tissue mass with marginal calcification and increased tracer uptake on fused images. The surveyed skeleton shows multiple aggressive lytic lesions with osteoblastic activity at D11 vertebra, sacrum, pelvic bones, and left proximal femur consistent with osteoblastic bone metastases. Double density foci (hotter spot within hot area) are due to soft tissue contrast uptake at the primary calcified urinary bladder mass and relative mild tracer uptake in the non-radioactive urine in the bladder.



**Figure 2.** Diagnostic CT a) pre-contrast, b) contrast and, c) delayed portovenous phase images showing focal lesions of varying sizes in the urinary bladder. The largest lesion was at the right uretero-vesicle junction with evidence of extra mural and perivesical fat stranding with marginal interrupted calcification. Another suspicious lesion is seen in the left anterolateral wall. (d) Fused <sup>18</sup>F-NaF PET/CT images in soft tissue window show <sup>18</sup>F-NaF uptake at the calcification.

Bladder transitional cell carcinoma is the second most common urinary tract malignancy (1). Common sites of metastasis are nodal, skeletal, hepatic, pulmonary, and adrenal glands (2). Among these, the spinal axis where these are usually lytic (3). <sup>18</sup>F-NaF is an excellent bone-seeking tracer with predominant skeletal uptake due to quick first-pass extraction, minor plasma protein binding and rapid renal excretion. After one hour of administration, around 10% of this tracer is found in plasma (4). <sup>18</sup>F-NaF PET/CT is highly sensitive in characterizing both blastic and lytic lesions. Due to its excellent spatial resolution, this tracer is can also identify increased bone turnover along the thin reactive border around bone lysis (5). Thus, this was a case with depicting lytic bone metastases and extra osseous <sup>18</sup>F-NaF uptake in calcified urinary bladder mass (double density sign).

<sup>18</sup>F-NaF can be localized in extraosseous calcifying lesions. Skeletal primary and metastatic foci can absorb <sup>18</sup>F-NaF because of either tumoral calcification or calcifications within necrotic foci (6). In literature, there are examples of extraosseous <sup>18</sup>F-NaF uptake for both malignant (brain, cardiac, lymph nodes, liver metastases) and benign etiologies (cardiac amyloidosis, meningioma and lung amyloidosis) (7,8,9). The mechanisms of extraosseous <sup>18</sup>F-NaF uptake are unclear. Several postulates reveal that the process underlying active calcium turnover demonstrates <sup>18</sup>F-NaF uptake. Extraosseous <sup>18</sup>F-NaF uptake is often encountered. Thus, the recognition of extra osseous <sup>18</sup>F-NaF uptake is essential for precise diagnosis and interpretation.

## Ethics

**Informed Consent:** The institutional review board waived the need to obtain informed consent.

**Peer-review:** Externally and internally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practices: S.U., Concept: S.U., N.A., Design: S.U., N.A., Data Collection or Processing: S.U., N.A., Analysis or Interpretation: S.U., N.A., Literature Search: S.U., Writing: S.U., N.A.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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