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Multimodality imaging in biochemical recurrence of prostate cancer: Utility of ^{18}F -NaF PET/CT in early detection of metastasis

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A 54-year-old male with biopsy proven Gleason 9 prostate cancer presented with rapidly increasing serum PSA level of 12.4 ng/ml and PSA doubling time <1 month after radical prostatectomy. Conventional imaging scans (chest, abdomen and pelvis CT and $^{99\text{m}}\text{Tc}$ -MDP bone scintigraphy) were obtained which identified a single equivocal mildly sclerotic and active lesion in T8 vertebral body (Fig. 1). The patient was then enrolled in an ongoing prospective clinical imaging trial designed to assess the diagnostic utility of ^{18}F -FDG PET/CT and ^{18}F -NaF PET/CT in men with biochemical recurrence of prostate cancer and negative or equivocal standard imaging. While ^{18}F -FDG PET/CT was negative, ^{18}F -NaF PET/CT demonstrated numerous randomly distributed fluoride avid lesions in the skeleton (cervical/thoracic/lumbar spine, bilateral acetabuli pelvis, right clavicle) compatible with skeletal metastases (Fig. 2). Follow-up MRI of the spine confirmed the bony lesions (see Fig. 1). Patient was then started on androgen deprivation therapy (bicalutamide/leuprolide acetate) and radiotherapy to a painful area in lower-thoracic spine (3250 cGy to T7–T11) after which his PSA declined to 0.6 ng/ml. Follow-up ^{18}F -NaF PET/CT showed increase in sclerosis on CT and decline in NaF uptake at sites of skeletal metastases. Conventional bone scintigraphy and CT are standard in the imaging evaluation of men with suspected metastatic disease based on rising serum PSA level. However, when available, ^{18}F -NaF PET/CT should be considered since it may be useful in early detection of occult skeletal metastases as clearly demonstrated here in our case.^{1–3}

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Fig. 1. Initial imaging evaluation of a man with biochemical relapse of prostate cancer: (A) equivocal ^{99m}Tc MDP bone scan, (B) equivocal sagittal view of thoracic spine CT, (C) sagittal view of follow-up thoracic spine MRI (performed after ^{18}F -NaF PET/CT) demonstrating osseous metastases, and (D) negative maximum intensity projection image of ^{18}F -FDG PET/CT.

Fig. 2. Demonstration of widespread osseous metastatic disease with ^{18}F -NaF PET/CT: maximum intensity projection images of ^{18}F -NaF PET/CT (A) at baseline, (B) at 6 months after start of therapy, (C) transaxial CT and fused ^{18}F -NaF PET/CT appearance of a lesion in L4 at baseline and at 6 months with demonstration of therapy-induced decline in lesion ^{18}F -NaF uptake and increase in sclerosis.