First Experience with Chemokine Receptor CXCR4-Targeted PET Imaging of Patients with Solid Cancers.

CXCR4 is a chemokine receptor that is overexpressed in various human cancers and is involved in tumor metastasis. The aim of this proof-of-concept study was to evaluate a novel CXCR4-targeted PET probe in patients with solid cancers with reported in vitro evidence of CXCR4 overexpression and to estimate its potential diagnostic value. Twenty-one patients with histologically proven pancreatic cancer, laryngeal cancer, non-small cell lung cancer, prostate cancer, melanoma, breast cancer, hepatocellular carcinoma, glioblastoma, sarcoma, or cancer of unknown primary underwent PET imaging using the novel CXCR4 nuclear probe (68)Ga-pentixafor. The SUVmax of the liver, spleen, and bone marrow was measured to determine physiologic tracer distribution. For evaluation of tracer accumulation in solid cancers, SUVmax and tumor-to-background (T/B) ratios were determined in a total of 43 malignant lesions, including 8 primary tumors, 3 locally recurrent tumors, and 32 metastases. When available, the SUVmax of malignant lesions was compared with the corresponding SUVmax measured in routine (18)F-FDG PET. Moderate tracer accumulation was detectable in the liver, bone marrow, and spleen, with a
mean SUVmax of 3.1, 3.7, and 5.6, respectively. By visual interpretation criteria, 9 of 11 primary and locally recurrent tumors were detectable, exhibiting a mean SUVmax of 4.7 (range, 2.1-10.9) and a mean T/B ratio of 2.9. Twenty of 32 evaluated metastases were visually detectable (mean SUVmax, 4.5 [range, 3.2-13.8]; mean T/B ratio, 2.8). The highest signal was detected in a patient with non-small cell lung cancer (SUVmax, 10.9; T/B ratio, 8.4) and a patient with cancer of unknown primary (SUVmax, 13.8; T/B ratio, 8.1). Compared with (18)F-FDG PET, which was additionally performed in 10 patients, (68)Ga-pentixafor PET had a lower SUVmax in all measured malignant lesions. On the basis of these first observations in a small and heterogeneous patient cohort, the in vitro CXCR4 expression profile of solid cancers and metastases described in the previous literature does not seem to sufficiently depict the in vivo distribution revealed by CXCR4-targeted PET. Moreover, the detectability of solid cancers seems to be generally lower for (68)Ga-pentixafor than for (18)F-FDG PET.