Clinical Utility of Prostate-Specific Membrane Antigen-Targeted Imaging in Men with Prostate Cancer.

Steven P. Rowe MD PhD[1], Michael A. Gorin MD[2], Mohamad E. Allaf MD[2], Ashley E. Ross MD PhD[2], Zsolt Szabo MD PhD[1], Steve Y. Cho MD[3], Kenneth J. Pienta MD[2], Martin G. Pomper MD PhD[1]

[1]The Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, USA

[2]The James Buchanan Brady Department of Urology and Urological Institute, Johns Hopkins University School of Medicine, Baltimore, MD, USA

[3] Department of Radiology, University of Wisconsin School of Medicine and Public Health and University of Wisconsin Carbone Cancer Center, Madison, WI, USA

Background: Although prostate cancer (PCa) is the most common non-cutaneous malignancy in men, conventional imaging with magnetic resonance imaging in localized disease and ^{99m}Tc-methylene diphosphonate bone scan (BS) and computed tomography (CT) in the recurrent and metastatic settings have lacked the sensitivity and specificity necessary to guide appropriate treatment in many patients. As a result, numerous molecular imaging agents have been developed to more accurately detect sites of PCa. Among these agents are those targeting prostate-specific membrane antigen (PSMA), a cell surface receptor that is highly expressed in the vast majority of PCa. ^{18}F-DCFPyL is a small molecule positron emission tomography (PET) agent targeting PSMA that has demonstrated particular promise.

Methods: All imaging protocols were approved by the hospital Institutional Review Board. 10 patients with known progressive metastatic PCa, 50 patients with biochemical recurrence after definitive treatment with prostatectomy or external beam radiation therapy, and 25 patients with newly diagnosed National Comprehensive Cancer Network high- and very-high-risk primary PCa planned for prostatectomy with pelvic lymph node dissection were recruited. All patients underwent imaging with ^{18}F-DCFPyL PET/CT 60 minutes post-injection of radiotracer, with an additional 120-minute post-injection time point in the patients with metastatic PCa.

Results: A lesion-by-lesion analysis of the 10 patients with metastatic PCa demonstrated a markedly improved lesion detection by ^{18}F-DCFPyL PET/CT in comparison to conventional imaging. ^{18}F-DCFPyL PET/CT identified 170 definitive sites of abnormal uptake suspicious for foci of PCa with one additional site of equivocal uptake versus 30 definite and 15 equivocal lesions with combined BS and CT conventional imaging. This putative improved sensitivity for lesion detection was borne out further by the findings in the biochemical recurrence cohort, in which 30/50 (67%) of patients were found to have ^{18}F-DCFPyL uptake suspicious for a site or sites of recurrent disease; while all of the biochemical recurrence patients had been imaged with BS and CT, none had findings indicative of disease with conventional imaging. In the pre-prostatectomy patients, 25/25 (100%) had definitive uptake in the prostate; in addition, 5/9 (56%) patients with pathology confirmed pelvic lymph node involvement had nodal uptake with ^{18}F-DCFPyL while none of the patients had evidence of nodal involvement on conventional imaging.

Conclusions: The available data support that PSMA-targeted imaging with ^{18}F-DCFPyL PET/CT has improved detection of foci of PCa in comparison to conventional imaging in a variety of clinically relevant contexts including metastatic disease, biochemical recurrence, and high-risk primary PCa. However, there has been no definitive demonstration of the effect of these findings on patient management or outcomes. As such, a study measuring the change in pre- versus post-^{18}F-DCFPyL PET/CT management plans is needed and is currently underway.