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Effective PSMA-based ^{18}F -DCFPyL guided cryoablation of a single positive site in a patient believed to be metastatic on ^{11}C -Choline PET/CT

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Abstract

PET/CT-guided interventions using specific radiotracers are promising for detecting avid lesions not well visualized with other imaging methods. A 72-year-old man who initially presented with prostate cancer Gleason 5+4 (prostate-specific antigen (PSA) = 7.9 ng/ml) underwent radical prostatectomy and pelvic node dissection. Three years after radiation, a rapid rising PSA was observed over 6 months with PSA level reaching 1.08 ng/ml. He was evaluated with prostate-specific membrane antigen (PSMA)-based ^{18}F -DCFPyL radiotracer PET/CT, conventional CT, ^{18}F FDG PET/CT, and ^{11}C Choline PET/CT. PSMA-based ^{18}F -DCFPyL PET/CT successfully targeted oligometastatic prostate cancer whereas the other imaging studies were not successful in assessing disease extent.

Keywords

Cryoablation; Lymph nodes; PSMA; Prostate tumor; PET/CT; molecular imaging

PET/CT-guided interventions using specific radiotracers seem promising for detecting avid lesions not well visualized with other imaging methods [1–4]. In patients presenting with metastatic castration resistant prostate cancer, prostate cancer may have low and heterogeneous utilization of glucose and thus FDG-PET may fail to detect lesions [5]. Conventional imaging such as CT can be negative or unable to differentiate active vs non active lesions [6]. As choline is an essential component of phospholipids that compose the cell membrane, carbon-11 or fluorine-18 choline PET/CT have been used where the uptake reflects only the increased cell proliferation as well as the activity of the enzyme choline kinase in prostate cancer cells; however, this method still lacks specificity [9]. As PSMA is expressed by virtually all prostate cancers, PSMA-based radiotracers such as ^{89}Zr labeled

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monoclonal antibody huJ591 or the ^{18}F -DCFPyL inhibitor as was used in this case have been successfully used to target biopsies on PET-positive sites, demonstrating high sensitivity and specificity [7,8]. Molecular imaging is changing the efficiency of interventional procedures wherein new molecular probes beyond FDG are being applied [10]. These new radiotracers allow us to appreciate abnormalities that are not visible on anatomic images, leverage increased target specificity, and improve extent of disease assessment [11].

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Figure 1.

A 72-year-old man who initially presented with prostate cancer Gleason 5+4 (prostate-specific antigen (PSA) = 7.9 ng/ml) underwent radical prostatectomy and pelvic node dissection. As the PSA remained 0.17ng/ml one year after surgery, radiation was delivered to the pelvis (70 Gy). Androgen deprivation therapy was added for 6 months. Three years after radiation, a rapid rising PSA was observed over 6 months with PSA level reaching 1.08 ng/ml. A) The ^{18}F FDG PET/CT study concluded post-prostatectomy status without definite evidence of local recurrence. B and C) The ^{11}C Choline PET/CT study identified several hypermetabolic pelvic nodes that are possibly metastatic (arrows). D) The PET/CT study using prostate-specific membrane antigen (PSMA)-based ^{18}F -DCFPyL radiotracer revealed a single lymphadenopathy right superolateral to the pubic symphysis (SUV 3) (arrowhead). No other focal abnormal sites of radiotracer uptake within the pelvis were detected.

Figure 2.

Following discussion at a multidisciplinary meeting, based on PSMA-based ^{18}F -DCFPyL PET/CT findings, percutaneous cryoablation intended for local control of the single metastasis was proposed. Further surgery or radiotherapy was not recommended due to anticipated procedural difficulty related to scarring or cumulative radiation dose. A) The cryoablation procedure was performed under CT guidance and general anesthesia using a cognitive fusion of PET/CT images as the lymph node was observed on CT images (arrow). B) No complications occurred after cryoablation (arrowheads identify the ice ball) and the patient was observed in the hospital prior to same day discharge. Biopsy confirmed the diagnosis of prostate carcinoma. C and D) At the time of the last follow-up 6 months after the procedure, PSA remained undetectable and MR imaging negative (dashed arrows show a normal postoperative aspect after cryoablation of the lymph node either on T2-weighted image (C) and on T1-weighted post contrast image with fat saturation).