THE ROLE OF [18F] FLUCICLOVINE PET / MR IN PRIMARY PROSTATE CANCER

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ABSTRACT

Fluciclovine, a [18F]-tagged unnatural analog of the amino acid L-leucine, has been shown to be successful in the evaluation of primary and metastatic prostate cancer. [18F]Fluciclovine which has recently received FDA approval has been used with firstly PET/CT and secondly PET/MR in these patients. In some studies, it has been shown that [18F] imaging gave statistically more significant results than 11C-Choline and both clinically significant tumors and malignant - benign differentiation could be identified clearer after [18F] injection.

Key Words: [18F]Fluciclovine, PET/MR, Prostat cancer

INTRODUCTION

Prostate cancer (PCa) which is the most frequently diagnosed malignancy in men is second cause of cancer releated death in men in USA(1). Clinically insignificant prostate cancer rates have increased in direct proportion to the spread of screening in prostate cancer. Active surveillance(AS) is the preferable option for this kind of patients. However, in many studies, a significant proportion of patients on AS have been shown to have clinically significant prostate cancer during follow-up (2-4). For this reason, several genetic and imaging studies have been published and are being performed to facilitate the decision of management of primary prostate cancer, especially in low-risk patients. Furthermore, due to the increased interest in radical prostatectomy for the treatment of high-risk prostate cancer nowadays, there is a need for more accurate imaging for accurate staging compared to the past. There has been a growing interest in multiparametric MR and molecular imaging for the evaluation of local, local advanced, metastatic prostate cancer and after prostatectomy. Acetate being a fatty acid analogue, choline being a cell membrane analogue, fluciclovine being an amino acid analogue as a radioactive substance and new generation PSMA are used in molecular imaging (5-8).

IMAGING TECHNIQUES

Multiparametric MR consists of T2 weighted, diffusion weighted, dynamic contrast and MR spectroscopy images. However, in the PRIAS (Prostate Cancer Research International Active Surveillance) study MR spectroscopy images were not included in the multiparametric MR(9). Multiparametric MR is commonly used in repeat biopsies and moderate-high risk groups with planned curative treatment. However, lymph nodes can not be evaluated with this modality.

Many radioactive materials are used for molecular imaging to help assess lymph nodes and metastases. PET/CT imaging using anti-1-amino-3-18F-fluorocyclobutane-1-carboxylic acid ([18F]Fluciclovine) approved by the FDA and appears to be a guide in the evaluation of recurrent prostate cancer, particularly in the detection of distant metastases. It is also preferred increasingly in the staging of primary prostate cancer. According to a small number of studies, sensitivity

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and specificity of [18F]Fluciclovine in the detection of prostate cancer were 87% and 66%, respectively (10).

There has recently been an increased interest in PET / MR studies for less radiation exposure and better soft tissue imaging. Turkbey et al. compared **[18F]** PET / CT with T2 weighted MR in the detection of primary prostate cancer and found that the sensitivity and specificity of MR was higher. They emphazised that more accurate results could be obtained if **[18F]**Fluciclovine as a radioactive agent was used together with MR(11). Nanni et al. showed that (18)F-fluciclovine provided a significantly better performance in terms of lesion detection rate when compared with (11)C-choline (12).

In the prospective study of Elschot M. et al., the role of **[18F]** PET / MR in the detection and characterization of primary prostate cancer and the optimal evaluation time after application of [18F] were investigated. High-risk patients (biopsy gleason score ≥ 8 and/ or PSA ≥ 20 and/ or clinical stage ≥ cT_3) planned for robotic radical prostatectomy and lymph node dissection were included in the study. Researchers who applied the PET / MR protocol evaluated MR and 45-minute synchronous PET images with reference to the histopathological results. The evaluation times were divided into three groups according to the mean SUV (standardized uptake value) in order to determine the optimal evaluation time (W1: 5-10; W2: 18-23; W3: 33-38 minutes post-injection). Mean age of the twenty-eight patients included in this study was 66 (55-72), mean PSA was 14.6 (3.7-56.9 ng/ dl), mean gleason score was 8 (7-9), and clinical stage was between T_{2b} and T_{3b}. The mean time between imaging and surgery was 8 (5-32) days. In total, 28 prostates, 39 tumors (14 low/ intermediate, 25 high grade), 36 BPH, 6 inflammation and 28 healthy tissue analysis were performed. In this study, SUV mean and maximal values were found to be higher in W3 time interval between malignant and benign tissues, such as in high grade and low / intermediate grade tumors (tumour vs. BPH, 2.5 vs. 2.0 [p<0.001]; tumour vs. inflammation, 2.5 vs. 1.7 [p<0.001]; tumour vs. healthy tissue, 2.5 vs. 2.0 [p<0.001]). In addition, it was emphasized that lymph nodes should be assessed in the early period after application of [18F], but there is a need for further studies related to this topic(13). As a result, it has been shown that the optimal PET / MR evaluation interval was 33-38 minutes and both clinically significant tumors and malignant - benign differentiation could be identified clearer after [18F] injection.

TAKE HOME MESSAGE

[18F] Fluciclovine PET / MR is a promising imaging agent in prostate cancer with higher diagnostic performance and lower radiation exposure. However, more studies with comparative and large cohort are required to assess the clinical significance of the results in point of sensitivity, specificity, and accuracy.

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