18F-FDG-PET/CT versus 18F-Fluoride-PET/CT for Detecting Bone Metastases in Patients With Breast Cancer and Equivocal Bone Scan


Abstract
Whole-body bone scintigraphy (BS) with 99mTc-MDP has the highest cost-benefit ratio for bone metastasis (BM) diagnosis on breast cancer (BC) patients. However, BS frequently shows inconclusive findings, making necessary the use of complementary exams. This study aimed to compare 18F-Fluoride-PET/CT and 18F-FDG-PET/CT for the diagnosis of BM on BC patients with inconclusive BS for BM.

Key words: bone metastasis, fludeoxyglucose, fluoride.

Introduction
Bone is one of the most regular sites for metastasis on various carcinomas, being specially common on breast cancer (BC). The early detection of bone metastasis (BM) plays a major role on delivering the appropriate treatment for the patient.

Whole-body bone scintigraphy (BS) with 99mTc-MDP is the conventional test to find BM, due to its high cost-benefit ratio; however, BS frequently shows inconclusive findings, making necessary the use of complementary exams.

This study compared 18F-Fluoride-PET/CT and 18F-FDG-PET/CT for the diagnosis of BM on BC patients with inconclusive BS.

Results and Discussion
18 patients participated on this study. The inclusion criteria was: sign the informed consent document, show a BS with inconclusive findings for BM, been undiagnosed for BM and accept the realization of 18F-Fluoride-PET/CT and 18F-FDG-PET/CT.

The clinical and imaging follow-up identified BM on 12 of the 18 patients with inconclusive BS. The 18F-Fluoride-PET/CT detected BM on all the 12 patients, while 18F-FDG-PET/CT only found BM on 9 patients.

On 5 of the 12 BM patients, 18F-Fluoride-PET/CT diagnosed 26 additional BM, while 18F-FDG-PET/CT only found extra lesions on 2 of the 12 patients. However, 18F-FDG-PET/CT detected 48 additional BM, most of then in a single patient.

Together, both exams identified 68 lesions in addition to the 33 confirmed by BS, indicating a higher accuracy in relation to BS. 18F-Fluoride-PET/CT detected 67 of the 101 lesions, while 18F-FDG-PET/CT, 72 of the 101.

Chart 1. 18F-Fluoride-PET/CT and 18F-FDG-PET/CT sensitivity on detection of lytic, sclerotic, mixed and early stage lesions.

<table>
<thead>
<tr>
<th>Predominant characteristic on CT</th>
<th>Metastatic lesions (n = 101)</th>
<th>Sensitivity 18F-Fluoride-PET/CT (n = 67)</th>
<th>Sensitivity 18F-FDG-PET/CT (n = 72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lytic</td>
<td>19</td>
<td>68%</td>
<td>68%</td>
</tr>
<tr>
<td>Sclerotic</td>
<td>26</td>
<td>85%</td>
<td>42%</td>
</tr>
<tr>
<td>Mixed</td>
<td>4</td>
<td>75%</td>
<td>50%</td>
</tr>
<tr>
<td>Early stage lesion</td>
<td>52</td>
<td>55%</td>
<td>88%</td>
</tr>
</tbody>
</table>

Image 1. Female patient, 48 years old. (A) 18F-Fluoride-PET/CT showed lesions on left temporal bone, 1st, 6th and 10th left ribs, 9th right rib, T10 and sternum (red arrows). (B) 18F-FDG-PET/CT only identified the lesion on 6th left rib (blue arrow). (C, D) Axial images emphasizing sternum, 1st left rib and T10 lesions (green arrows), none of them were detectable on 18F-FDG-PET/CT.

Conclusions
On the present study, 18F-Fluoride-PET/CT was considered the best complementary exam to diagnose BM on patients with inconclusive BS findings. 18F-Fluoride-PET/CT had a higher sensitivity for sclerotic and mixed lesions, an equal sensitivity for lytic lesions and inferior sensitivity for early stage lesions. Interestingly, 18F-FDG-PET/CT detected a large amount of early stage lesions in a single patient; rising significantly his sensitivity for this kind of BM.