PET/CT versus MRI for detection of bone metastases in patients with breast cancer

J. Grankvist[1], R. V. Fisker[1], V. V. Iyer[2], F. T. Jensen[1], E-T. W. Fründ[1,3], C. W. Simonsen[1], T. Christensen[1], M. E. Kvistgaard[4], and E-M. Larsson[1]

[1]Department of Radiology, Aalborg Hospital / Aarhus University Hospital, Aalborg, Denmark, [2]Department of Nuclear Medicine, Aalborg Hospital / Aarhus University Hospital, Aalborg, Denmark, [3]Applied Science Laboratory Europe, GE Healthcare, [4]Department of Oncology, Aalborg Hospital / Aarhus University Hospital, Aalborg, Denmark

Introduction:

The project compares Magnetic Resonance Imaging (MRI) to 18-Flouro-Deoxy-Glucose Positron Emission Tomography fused with Computed Tomography (18-FDG PET/CT) in patients with bone metastases from breast cancer to the spine and pelvis. The aim of this prospective study is to determine if MRI (non-invasively and without ionizing radiation) can diagnose bone metastases as well as PET/CT, whether it is before, during or after treatment of the metastases.

Materials and Methods:

Breast cancer patients with suspected or known bone metastases are prospectively recruited from the Department of Oncology. So far 9 patients have been included and underwent both MRI and PET/CT with maximum 10 working days interval. PET/CT was reviewed by two radiologists, and their consensus was noted regarding potential metastases in 27 predefined locations. Two different radiologists reviewed the MRI studies and assigned metastasis in the same 27 predefined locations. The predefined locations were each of the vertebral bodies (24), the sacrum (1), left-(1) and right-(1) pelvic bones. A metastasis outside the mentioned locations was noted as "outside Field of View". The study was approved by the local ethics committee and written informed consent was obtained from all patients. For PET/CT examination a GE Discovery VCT was used. The following protocols have been applied on a 3T MR scanner (GE Signa HDx):

Spine: *Sagittal T1:* FastSpinEcho-XL, FOV 46cm, 2 NEX, BW 41.67MHz, TR/TE 800ms/min, freq 512, Phase 256, slice thickness/spacing 4.0/0.4mm, Echoes 1, Echo Train Length 3. *Sagittal STIR:* same parameters as "Sagittal T1" except TR/TI 4500/170ms.

Pelvis: *Coronal STIR:* FastSpinEcho, FOV 42cm, 2 NEX, TR/TE 850ms/min., Echoes 1, Echo Train Length 3, BW 41.67, freq 384, phase 256, slice thickness/spacing 8.0/1.0mm. *Coronal T1:* same parameters as Coronal STIR except TR/TI 4000/170ms, Echo Train Length 7.

Results:

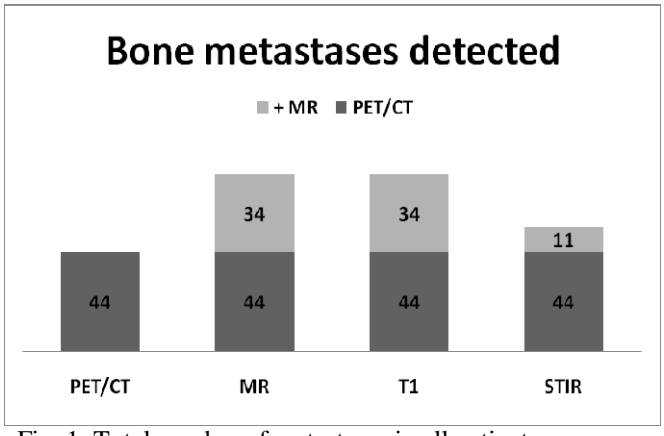

Fig. 1: Total number of metastases in all patients.

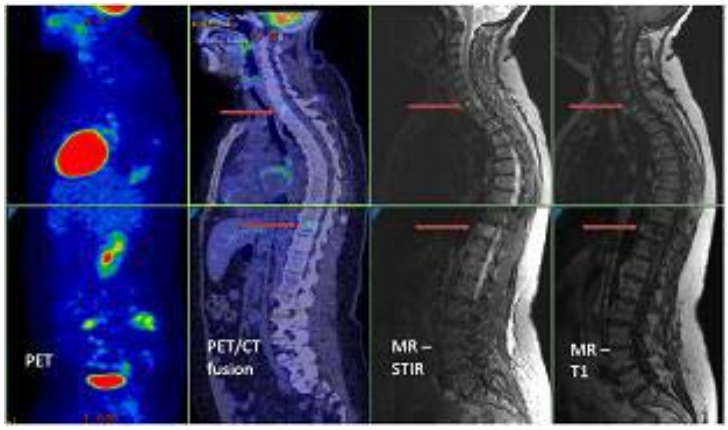

Fig. 2: Arrows show selected metastases, in one patient.

Metastases detected by PET/CT and MRI in the 27 locations in all 9 patients are shown in Fig. 1. All lesions seen on PET/CT were detected on MRI. Additional metastases seen on MRI, most likely represent post therapeutic residuals without active tumor. Metastases found outside the 27 locations included in this study: 1 patient has previously unknown liver metastases detected on PET/CT. 1 patient has previously unknown lung metastases detected on PET/CT. 1 patient has previously unknown brain metastases detected on MRI. 1 patient has a metastasis in the sternum detected on both modalities.

Discussion:

The larger the examined area, the more metastasis are found. Therefore we aim to determine whether MRI is as good as PET/CT in detecting metastasis in the spine and pelvic bones before expanding to whole body MRI. We have included patients regardless of current treatment (chemotherapy drugs, ionizing localized X-ray treatment, or no therapy at all). Chemotherapy may reduce glucose uptake and decrease the 18-FDG uptake in PET, explaining the larger number of lesions detected by MRI. Post treatment residuals cannot be differentiated from active metastases on the T1 sequence alone. STIR images could potentially help to differentiate active metastases from post therapeutic residual scars.