

Whole-body MRI vs. whole-body PET/CT in Staging of Newly Diagnosed Malignant Melanoma: Initial Results

F. M. Vogt¹, P. Veit¹, S. Massing¹, L. Freudenberg², R. Jablonka³, J. Barkhausen¹, G. Antoch¹

¹Diagnostic and Interventional Radiology, University Hospital, Essen, NRW, Germany, ²Nuclear Medicine, University Hospital, Essen, NRW, Germany, ³Dermatology, University Hospital, Essen, NRW, Germany

Introduction: Malignant melanoma is the most aggressive of skin tumor and frequently spreads to regional lymph nodes followed by organ metastases. Involvement of regional lymph nodes and potential infiltration of adjacent organs may be assessed using conventional imaging modalities but the accurate staging of disease extent remains challenging and mandates a whole-body examination. Recently available dual-modality Positron Emission Tomography / Computed Tomography (PET/CT) systems provide functional and morphologic information but the accuracy for staging of melanoma showed conflicting results. Additionally, PET/CT mandates the administration of iodine-based contrast agents and goes along with a significant radiation exposure. Contrast-enhanced whole-body MRI can be used for whole-body tumor staging and may be an attractive alternative. The purpose of this study was to compare the accuracy of whole-body MRI and whole-body PET/CT imaging for staging of patients with newly diagnosed melanoma.

Methods: 31 patients with newly diagnosed melanoma of the skin underwent tumor staging with whole-body PET/CT and whole-body MRI covering the head to the upper thighs. MRI was performed on a 1.5 T scanner (Sonata™, Siemens Medical Solutions) using a commercially available rolling table platform (BodySurf™) with an integrated torso phased array coil for whole-body coverage. The imaging protocol included T1 and T2-weighted sequences of the liver and the thorax, complemented by seven overlapping contrast-enhanced axial 3D-VIBE data sets (TR/TE 3.1/1.2 ms, FA 12°, slab thickness 312 mm, partitions 102, slice thickness 3mm, matrix 240 x 512) for whole-body coverage. PET/CT imaging (biograph™, Siemens Medical Solutions) was accomplished one hour after intravenously injecting 350 MBq of [¹⁸F]-2-fluoro-2-deoxy-D-glucose (FDG). 140 ml of a iodinated contrast agent (300mg iodine/ml) were applied to provide fully diagnostic CT data. PET/CT and MRI data sets were evaluated each by two radiologist in consensus and PET/CT images were additionally viewed by two nuclear medicine physicians. Readers were blinded to the results of the other imaging procedure and diagnostic accuracies of the two imaging procedures were compared for assessing the NM stage. Histology and a clinical follow-up of after a mean 295 days served as the standards of reference. Differences between the two staging procedures were tested for statistical significance by the McNemar's test.

Results: The overall NM tumor stage was correctly determined in 21 / 31 patients (68%) with MRI and in 23 / 31 patients (74%) with PET/CT ($p>0.05$). Separate assessment of N-stage revealed MRI to be accurate in 25/ 31 (81%) and PET/CT in 28 / 31 (90%) of the patients ($p>0.05$). M-stage was correctly determined in 23 / 31 patients (74%) with MRI and in 24 / 31 of the patients (77%) with PET/CT ($p>0.05$). N-stage was overstaged with MRI and PET/CT in no patients and understaged in 3 patients with PET/CT and 6 patients with MRI. Distant metastases were overstaged with PET/CT in 1 and understaged in 5 patients, with MRI in 1 and 7 patients, respectively. Due to prior resection of the primary tumor, histopathology of all primary tumor sites was available, but T-stage was not assessed separately.

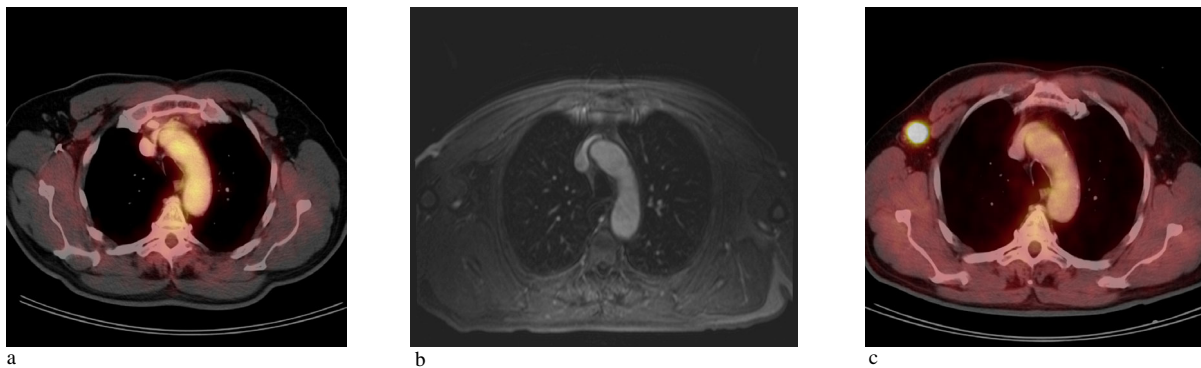


Fig.1: 63 y old male with primary melanoma of right upper arm (Clark 4). Fused PET/CT imaging (a) and the MRI data set (b) demonstrate no enlarged lymph nodes. However, follow up PET/CT after 3 month revealed focally increased glucose metabolism within an enlarged axillary lymph node suspected of metastasis. Histology proved axillary lymph node involvement (N2-disease).

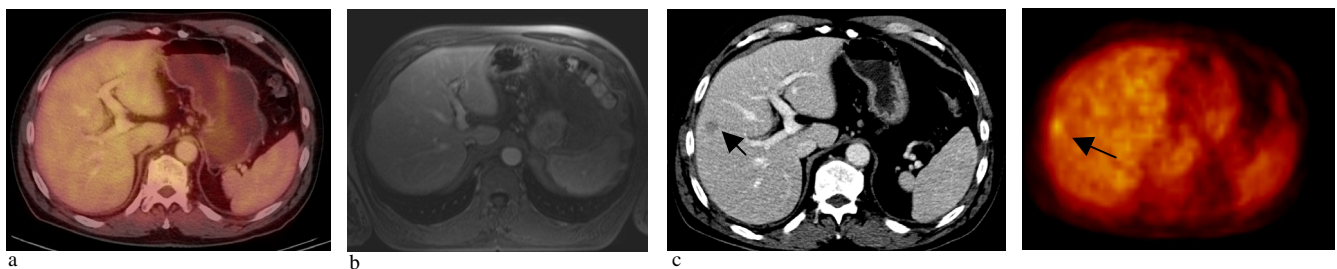


Fig.2: 69 y old male with primary melanoma of right chest wall (Clark 3). Fused PET/CT (a) data and MRI (b) do not demonstrate any pathology. Follow up CT (c) and PET(d), however, reveals hepatic lesion with FDG uptake (arrows). Further follow up examinations proved this lesion to be a metastasis by rapid increase of size.

Discussion: A significant number of patients initially staged as N-negative an M-negative with whole-body MRI and PET/CT eventually proved to have undetected regional or distant metastases, thus leading to low accuracy for both modalities. Based on those results for initial tumor staging, close follow-up examinations either by whole-body MRI or PET/CT seem to be mandatory to screen for recurrent disease, especially in cases of a single metastasis that could be surgically removed.