

## The Diagnostic Ability of Diffusion Weighted Imaging with Background Body Signal Suppression (DWIBS) in Bone Metastasis

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**Introduction:** Diffusion weighted imaging is now routinely used in imaging the central nervous system. Recent advances in magnetic resonance (MR) technology such as parallel imaging extended the indication to body field. Several researchers have reported that various malignancies in the body show similar abnormal intensities (1).

**Purpose:** The aim of this study is the evaluation of the diagnostic power of diffusion weighted imaging with background body signal suppression (DWIBS) in determining bone metastasis comparing with whole body <sup>11</sup>C- methionine positron emission tomography (MET-PET) and technetium-99m-methylene diphosphonate (<sup>99m</sup>Tc-MDP) bone scan.

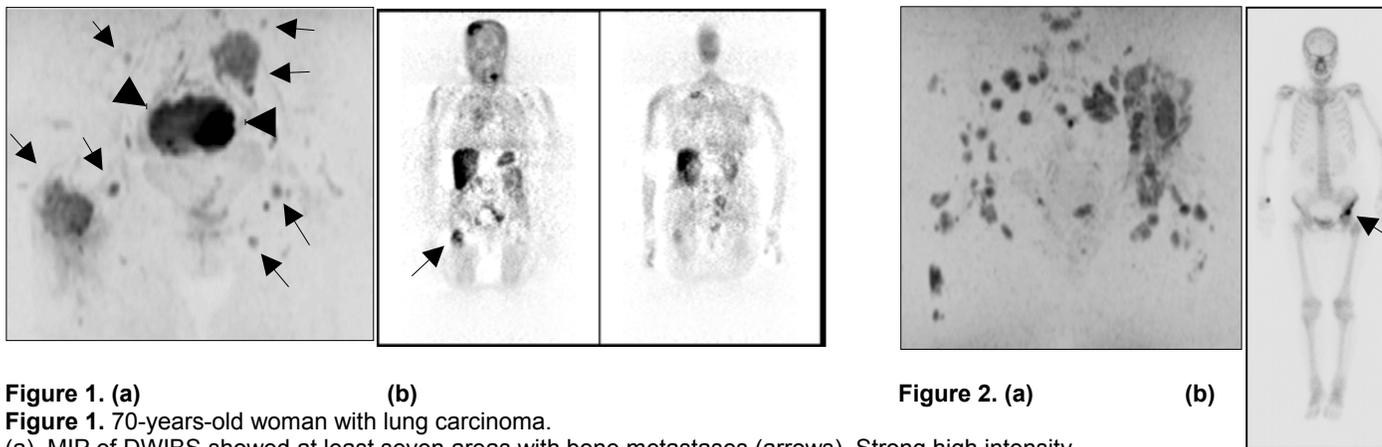
**Material and Methods:** This is a retrospective study involving 10 patients (8 Female, 2 male; age range, 30-75 years; mean age: 61.7 years) with bone metastasis. Primary malignancies are as follow: 3 patients with head and neck malignant melanoma, 1 each with mandible squamos cell carcinoma, lacrimal gland adenoid cystic carcinoma, thyroid cancer, breast cancer, lung cancer, renal cancer and colon cancer. MR imaging was performed with using a 1.5 Tesla MR imaging unit (Philips Medical Systems, Netherlands). Four-5mm slice thickness DWI in the axial direction was obtained by using b-value of 1,000 sec/mm<sup>2</sup> during free breathing. Short T1 inversion recovery (STIR) was used for body fat suppression. Examination was performed in the identical transverse field of view that suspected contain bone metastasis. The resulting DWIBS images were displayed by using black and white inverse gray scales, in order to make comparison with MET-PET and bone scan easier. Bone metastasis was diagnosed as an area with high signal intensity (black area on inverse display). Original axial and maximum intensity projection (MIP) images of DWIBS were interpreted compatible with T1 weighted and gadolinium enhanced MR images. The results of DWIBS were compared with whole body MET-PET (in 6 patients) and <sup>99m</sup>Tc-MDP bone scan (in 4 patients). The time interval between performing DWIBS and MET-PET or bone scan was less than two weeks. Diagnosis of bone metastasis was confirmed on the basis of T1 weighted and gadolinium enhanced MR images and supported by follow up studies.

**Results:** In 6 cases MET-PET identified 20 lesions as bone metastasis, while DWIBS demonstrated 27 lesions.

Concordant between DWIBS with MET-PET were seen in four cases with 6 lesions. The major differences between DWIBS and MET-PET were in two cases which the lesions were located in pelvic cavity; however, DWIBS needed side-by-side comparison with conventional MRI in order to increase specificity. MET-PET showed more metastatic lesions in one patient with head and neck tumors in compare with DWIBS. Bone scan identified 4 lesions as bone metastasis in 4 cases, while DWIBS identified 23 lesions. In four patients who comparison was performed between DWIBS and bone scan, there were same results in three patients; major difference was in one patient with pelvic bone metastasis.

**Conclusion:** DWIBS is a very sensitive method for finding bone metastasis especially in pelvic cavity which is superior to MET-PET and bone scan; although for providing specificity side-by-side comparison with conventional MR imaging is necessary.

**References:** 1. Takahara T, Imai Y, Yamashita T, Yasuda S, Nasu S, Van Cauteren M. Diffusion weighted whole body imaging with background body signal suppression (DWIBS): technical improvement using free breathing, STIR and high resolution 3D display.



**Figure 1. (a)**

**(b)**

**Figure 1.** 70-years-old woman with lung carcinoma.

(a) MIP of DWIBS showed at least seven areas with bone metastases (arrows). Strong high intensity in the pelvis (arrow head) was dermoid cyst.

(b) Whole body PET scan revealed two lesions suspected to be bone metastasis in the right femur and left sacral regions.

**Figure 2.** 75-years-old woman with nasal malignant melanoma

(a) DWIBS showed multiple pelvic bone metastases. (b) Bone scan revealed one bone metastasis in the left iliac crest (arrow).