Original Article

Radiology

DWIBS Imaging: Modifying MRI to Monitor Metastases

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ABSTRACT

Whole body imaging is a vital prerequisite for the management of patients with malignancies. Although bone scans and PET-scans are routinely used in the follow up of oncology patients to evaluate metastases, their limited availability and inherent radiation exposure indicate that there is a strong need for a non invasive, radiation free, whole body imaging modality. Diffusion weighted, whole body magnetic resonance imaging with a background body signal suppression (DWIBS) MRI technique fulfills this much awaited need, as shown by the few examples which have been discussed in this article. DWIBS satisfactorily shows the presence and the extent of the bone as well as the soft tissue metastases. Other MRI sequences may be used when an in depth evaluation of the pathology is desired.

Key Words: Cancer imaging, Whole Body Imaging, DWIBS MRI, Bone scan, PET scan

INTRODUCTION

Whole body imaging to detect the presence, site, size and the number of bone as well as soft tissue metastases, is vital for deciding the management in oncology. Bone scans or PET-CT scans are widely used for this purpose. But as the oncology patients are already weakened, not only by the disease entity itself, but also by chemotherapy, there is a possibility that the exorbitant diagnostic radiation which is involved in the bone scans or the PET-CT scans may turn out to be the proverbial last straw on the camel's back. It is noteworthy that MRI can detect bone metastases even before they manifest on the bone scan [1].

Through this article, we would like to share our experience of whole body imaging in various oncology patients by using Diffusion weighted Whole body Imaging with Back ground body signal Suppression (DWIBS). It has given satisfactory results and it promises to be a viable alternative to bone scans or PET-CT scans in terms of the ease, efficiency and economy.

MATERIALS AND METHODS

All the scans were performed on a 1.5 Tesla Philips MRI machine after informed written consent was obtained from the patients prior to the study. Dr. Takahara from Tokai University Hospital, Japan, originally developed the DWIBS protocol by using the SENSE parallel imaging technique [1]. The parameters which were used at our institute are tabulated in [Table/Fig-1].

Parameter	Value
TR	> 5000ms
TE	< 70ms
EPI factors	47
SENSE factor	2
b value	1000 sec / mm
Slice thickness	4 mm
Breath hold	Not needed
Total acquisition time	10 min.

[Table/Fig-1]: MRI Parameters used for DWIBS study in our institute

Axial slices were reformatted to produce a whole body image with the inversion of the grey scale,so that the final images resembles bone scan or PET scan like images, which are now well accepted by the referring medical fraternity.

3D reconstructed Short Tau Inversion Recovery images (STIR) with background suppression were taken when further anatomical details were desired.

RESULTS FROM REPRESENTATIVE STUDIES

The DWIBS image [Table/Fig-1] in a 45 years old healthy male showed the normal, hypo intense appearance in the brain, the central spinal canal, the stomach, the spleen and the pelvis.

The DWIBS image [Table/Fig-2] in a patient who was 58 years of age; who was operated 2 years ago for carcinoma of the cervix showed pronounced hypo intense signals which were indicative of metastases in the sternum, the left hemi thorax, the left iliac blade and the left femur.

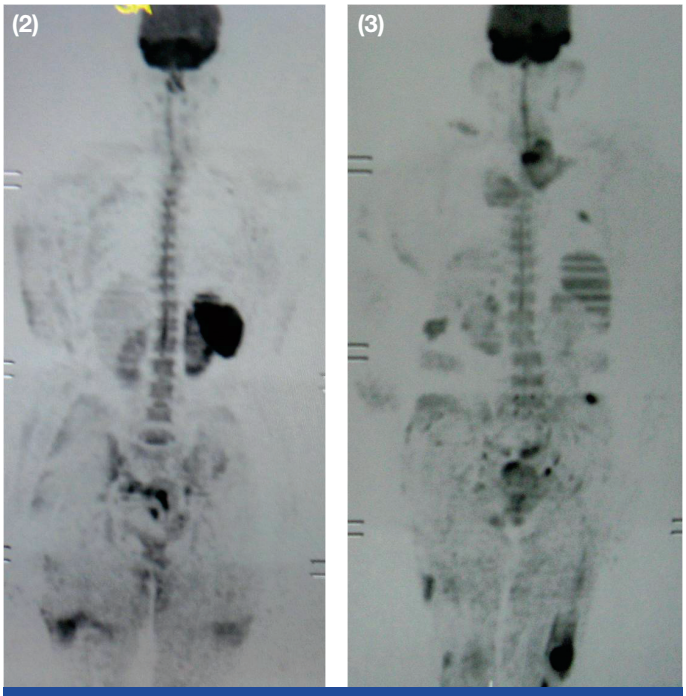
The DWIBS image [Table/Fig-3] of a 62 years old female, who was operated 3 years earlier for carcinoma of the ovary, showed multiple, vertebral, left supraclavicular and thoracic nodal metastases, which were demonstrated as hypo intense signals.

The DWIBS image [Table/Fig-4] in a 51 years old female, who had carcinoma of the left breast, was seen as a big hypo intense lesion in the left hemi thorax. No metastases are seen at this stage.

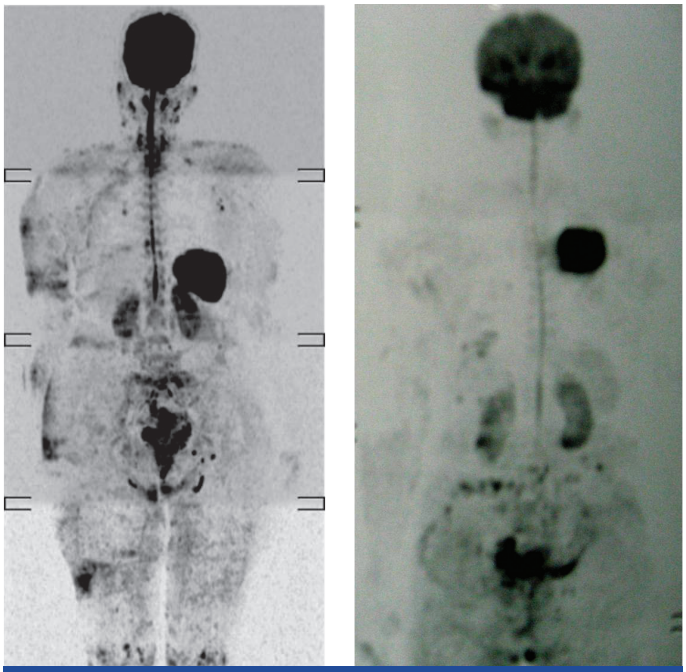
The DWIBS image [Table/Fig-5] in a 71 years old female, who was operated 7 years ago for carcinoma of the left breast and presented now with back ache. Multiple, vertebral and left axillary metastases are seen as abnormal hypo intensities on DWIBS.

DISCUSSION

The areas which are affected by malignancies or metastases appear bright on Diffusion Weighted Imaging (DWI), as the presence of many cellular membranes in the high cellularity tumours restricts the diffusion. To make them acceptable to the referring doctors as



[Table/Fig-1 & 2]: (1) DWIBS image in a normal healthy volunteer (2) DWIBS image in a patient operated earlier for carcinoma cervix shows metastases in the sternum, left hemi thorax, left iliac blade and left femur.



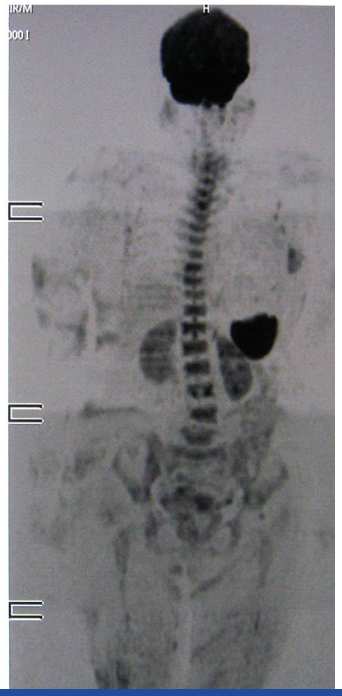
[Table/Fig-3 & 4]: (3) DWIBS image in a patient operated earlier for carcinoma ovary shows multiple vertebral, left supraclavicular and thoracic nodal metastases. (4) DWIBS image in a patient having carcinoma of left breast. Primary lesion is visible. No bony or soft tissue metastases are seen.

bone scans or PET scan images, the DWIBS images are printed with an inversion of the grey scale [2,3].

We believe that whole body imaging with DWIBS is a better choice than bone scans or PET scans, as shown in [Table/Fig-2].

On DWIBS, non-pathological liver, gall bladder, spleen, kidneys etc. also show up and benign conditions like abscesses can mimic malignancy [4]. We therefore take additional MRI sequences like T1W, T2W and STIR whenever they are indicated.

Thus, in onco-imaging, DWIBS can be used to stage the disease and to monitor the response to the treatment. Non-tumoural and post therapeutic changes do not show significant diffusion



[Table/Fig-5]: DWIBS image in a patient operated earlier for carcinoma breast and now presented with back ache. Multiple vertebral and left axillary metastases are seen.

restriction due to a low cellular density that is seen in persistent or recurrent tumour tissues. Thus, these two conditions can be differentiated [4].

Whole body imaging by using PET scans and bone scans has shown discrepancies in the results [5, 6]. MRI has shown bone metastases even when the bone scans were [7, 8]. Therefore, comparative studies between DWIBS, bone scans and PET scans are needed [9,10] in centers where they are possible and in countries where they are affordable, so that the best whole body imaging modality can be found out for patients who suffer from malignancies.

CONCLUSION

Intrinsic radiation hazards, costly studies, scarce availability and the prolonged waiting periods of PET-CT and bone scans can be easily tackled if DWIBS MRI is universally used for whole body imaging in cancer patients.

At the same time; multicentric, global, comparative, whole body imaging studies by using bone scans, CT scans, PET scans and DWIBS are the need of the hour to establish the statistical details about the sensitivity and the specificity of each modality, as compared to DWIBS, because DWIBS has the potential

S No.	Criteria	Bone Scan	PET Scan	DWIBS MRI
1	Availability	Less	Lesser	More
2	Prior preparation	Needed	Needed	Unnecessary
3	Scan Time	More	More	Less
4	Radiation Exposure	Yes	Yes	No
5	Repeatability	Limited	Limited	Unlimited
6	Usage in Pregnant patients	No	No	Unlimited
7	Usage in Pediatric patients	Limited	Limited	Unlimited
8	Cost of study	More	More	Less

[Table/Fig-6]: Comparative analyses of various imaging techniques for evaluating skeletal metastases

to significantly ease the 'diagnostics' which are related to the sufferings of cancer patients.

ACKNOWLEDGEMENT

All the patients who have undergone DWIBS and their referring doctors are hereby thanked for the trust that they have displayed in us and in DWIBS.

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DECLARATION ON COMPETING INTERESTS:

No competing Interests.

Date of Submission: **May 16, 2011**
Date of peer review: **Aug 07, 2011**
Date of acceptance: **Aug 09, 2011**
Date of Publishing: **Nov 30, 2011**