# Assessing Extracranial Tumors using Diffusion-Weighted Whole-Body MRI

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## Introduction

Diffusion-weighted imaging (DWI) is a well established technique in MRI. Especially the application to intracranial diseases (i.e. cerebrovascular accidents) became important in the last two decades [1]. Apart from that, there is growing interest in the application of DWI to patients with extracranial pathology. One feasible measurement technique, referred to as diffusion-weighted whole-body imaging with background body signal suppression (DWIBS), was introduced in 2004 by Takahara et al. [2]. In this work, preliminary results from the application of DWIBS to extracranial tumors are presented.

## Theory

In comparison to free diffusion, the water diffusion in biologic tissues is hindered due to interactions with cell membranes and macromolecules. The degree of restriction correlates inversely with the tissue cellularity and the integrity of cell membranes, leading to more restricted water diffusion in tissues with high cellular densities, i.e. tumor tissues. In DWI, the degree of water motion is found to be proportional to the degree of signal attenuation, whereby tumors show particular high signal magnitudes [3].

## Material and Methods

Patients were measured on a 1.5T Siemens MRI scanner. Free-breathing DWIBS was acquired at 5-7 different image stations using either a coronal or an axial STIR ss-EPI sequence with parameters TR=7800 ms, TE=58 ms, b=0, 800 s/mm$^2$, matrix=192, slice thickness=5 mm, FOV=50x31 cm$^2$. Total scan time for the DWIBS of one patient was 17 min.

## Results

Figure 1 shows an example of an inverse grey scale DWIBS image in a patient with lesions from multiple myeloma. Signals from normal tissue such as fat, muscle, blood vessels and bowel are suppressed. However, other normal structures, i.e. the spinal cord, liver, kidneys and spleen remain visible due to the restricted water motion. Furthermore and most important, hypercellular structures, such as tumor lesions (arrows) become clearly visible as hyperintense spots.

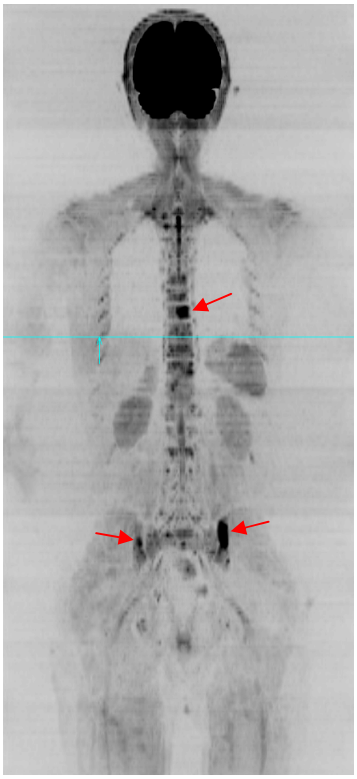

***Fig.1:*** *Example of diffusion-weighted whole-body imaging with background body signal suppression in a 49-year-old patient with lesions from multiple myeloma (arrows). Image is displayed using an inverse grey scale.*

## Discussion

DWIBS is an encouraging new, non-invasive technique for assessing extracranial tumors. At the moment, several studies are planned at the University of Basel Hospital, one of them comparing the two methods DWIBS and positron emission tomography (PET). Other studies have shown that DWIBS shows considerable promise for detecting and characterizing tumors and evaluating treatment response [4-6].

## References

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