
Preface

In 1827, the botanist Robert Brown described the presumably random drifting of particles suspended in a fluid. Nowadays, it is known as Brownian motion, which is a probabilistic process. In biological tissues, the extracellular water follows a Brownian motion, which is directly related to the tissue composition. Technological advances in magnetic resonance imaging (MRI) have made possible the detection of this microscopic motion by means of diffusion-weighted imaging (DWI). First used to detect brain ischemia, in the last decade, DWI has established as a robust imaging oncological biomarker with applications from head to toe. Its use outside the brain has been specially challenging due to the higher sensitivity of this technique to motion and susceptibility artifacts. However, the maturity of MRI technology has allowed its widespread use. Moreover, DWI forms part of today's clinical MR protocol in areas such as body, musculoskeletal, breast, or head and neck. This technique adds functional information about tissue composition to the conventional morphological sequences, with the advantage of need neither for intravenous contrast injection nor ionizing radiation.

Besides, DWI is fast and reproducible, showing a superb sensitivity to detect areas of high cellular content due to the restriction of extracellular water motion at this level. DWI is also a flexible technique that allows visual or quantitative assessment. Furthermore, the information of DWI may be added to vascular or metabolic information obtained by means of MR perfusion or MR spectroscopy. Therefore, in the era of functional imaging, DWI is one of the pillar which has converted MRI in a leading technique in this field.

Conversely, DWI has not still exploded its full potential. Available studies are still limited. At first, DWI was used as a detector of pathology, but now new oncological applications, as prediction of tumor response or early posttreatment monitorization, have to be completely explored. Besides, new groundbreaking applications of DWI are developing as whole-body DWI or DWI neurography. Other areas of work and cooperation are the need of standardization of protocols and to discover the most appropriate model of diffusion signal decay and parameter of quantification according to the explored system and clinical use.

The idea to write this book was to summarize the author's experience dealing in a daily clinical environment with DWI. We intend to transmit the pros and cons of this technique in a case-based format in order to be easy and fast reading. We have enjoyed and learned a lot during this process, and we hope the readers may share some of our experiences working with DWI outside the brain.

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Diffusion MRI Outside the Brain

A Case-Based Review and Clinical Applications

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