Preface

Scott B. Reeder, MD, PhD Pratik Mukherjee, MD, PhD
Guest Editors

Conventional MR imaging of the brain and body has traditionally relied on standard contrast mechanisms, namely T1- and T2-weighted imaging. In the 1990s, the advent of contrast-enhanced imaging for advanced angiographic and perfusion-weighted imaging (PWI) led to the improved characterization of brain tumors and brain ischemia. During the early to mid 1990s, qualitative diffusion-weighted imaging (DWI) of the brain revolutionized the detection of acute ischemic stroke and the management of ischemic neurological disease.

In the first decade of the 21st century, these early DWI and PWI techniques have evolved into more advanced methodologies for clinical practice, such as diffusion tensor imaging (DTI), fiber tractography, and arterial spin labeled perfusion imaging. Furthermore, diffusion and perfusion imaging are not just for the brain anymore. Their use has exploded throughout the body, including new applications in the spinal cord, abdomen, breast, and musculoskeletal system.

In this issue of *Magnetic Resonance Imaging Clinics of North America*, we provide updates on traditional applications of diffusion and perfusion imaging to ischemic stroke and brain tumors. We also explore exciting new uses for the assessment of neurodegenerative disease, spinal cord pathology, breast tumors, liver disease, prostate cancer, whole-body metastatic disease and lymphadenopathy, and musculoskeletal disorders. The articles included in this issue have been written by leading experts in the field (including physicists and expert practitioners in neuroradiological, abdominal, breast, and musculoskeletal applications), who provide comprehensive layman explanations of advanced DWI and PWI. It is our hope that this comprehensive body of work provides a state-of-the-art perspective on practical technical issues in DWI and PWI and new clinical applications.

Dr. Bammer and his team from Stanford University describe state-of-the-art methods in DWI and DTI, providing a comprehensive overview on the history of the development of DWI and its extension into quantitative applications. Dr. Berman from the University of California, San Francisco reviews the current methods using fiber tractography based on DTI and advanced high angular resolution diffusion imaging methods for the presurgical mapping of white matter tracts in brain tumor patients.

Dr. Hess from the University of California, San Francisco provides an overview of new findings using DTI to study Alzheimer's disease, an ever increasing public health problem in the 21st century. Then, Dr. Thurnher (of the Medical University of Vienna) and Dr. Law (of Mount Sinai Medical Center in New York) present new applications for DWI, DTI, and fiber tractography in the spinal cord: an exciting new frontier for neuroradiology.

Dr. Low from the Children's MRI Center in San Diego describes the use of DWI for whole body metastatic disease and the detection of lymphadenopathy. Dr. Bley from the University of Wisconsin describes the use of DWI for musculoskeletal applications, including examples in trauma, malignancies, and inflammatory conditions.

Switching the focus from DWI to PWI, Dr. Paladino and colleagues from Duke University provide an overview of the underlying mathematics behind quantitative perfusion weighted imaging, and how MR imaging can be used to extract

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key parameters that describe, in a quantitative manner, the microvasculature of the various malignancies.

Dr. Harris and colleagues from the University of Calgary review the expanding uses of diffusion and perfusion imaging in acute ischemic stroke, and they include an update on recent multicenter clinical trials that use DWI and PWI to triage patients for experimental interventions. Dr. Pollock and the team at Wake Forest University report on the routine use of arterial spin labeled perfusion in a busy academic neuroradiologic practice, showing how this new technology can be helpful in evaluating a wide range of cerebrovascular and other neurological disorders.

Dr. Moon and his colleagues from Yale University review state-of-the-art methods in dynamic contrast imaging for the detection and characterization of breast tumors. Dr. Do and colleagues from New York University outline the current status of dynamic contrast-enhanced imaging in the liver for detection and characterization of liver tumors and the quantification of chronic liver disease and early stages of hepatic fibrosis. Finally, Dr. McMahon and colleagues from the Beth Israel-Deaconess Medical Center in Boston review the use of dynamic enhanced MR imaging in the evaluation of patients who have prostate cancer; they include an up-to-date review of the literature and the extensive experience of perfusion MR imaging in prostate cancer at the Beth Israel-Deaconess Medical Center.

We thank all of the authors for their excellent contributions, which make this issue an outstanding overview of state-of-the-art methods in diffusion and perfusion imaging. We also thank Barton Dudlick of Elsevier for his support. We hope that the readers of this issue find the material both interesting and worthwhile in their clinical practice.

Scott B. Reeder, MD, PhD
Departments of Radiology, Medical Physics, Biomedical Engineering, and Medicine
University of Wisconsin
600 Highland Avenue, CSC E1/374
Madison, WI 53792, USA

Pratik Mukherjee, MD, PhD
Departments of Radiology and Bioengineering
University of California, San Francisco
San Francisco, CA, USA

E-mail addresses:
sreeder@uwhealth.org (S.B. Reeder)
pratik@radiology.ucsf.edu (P. Mukherjee)