
Preface

Functional neuroradiology represents a relatively new and ever growing subspecialty in the field of neuroradiology. Neuroradiology has evolved beyond anatomy and basic tissue signal characteristics and strives to understand the underlying physiological processes of CNS disease. This new and exciting field uses a variety of advanced imaging techniques that are constantly expanding due to ongoing research in one of the most advanced fields of medicine. These techniques are initially used to characterize primarily central nervous system lesions using diffusion, perfusion, permeability, MR spectroscopy, and positron emission tomography. Following lesion characterization, localization of the eloquent cortex and key white matter structures is then obtained with state-of-the-art blood oxygen level-dependent (BOLD) fMRI and diffusion tensor imaging (DTI) techniques.

This book is a comprehensive review and offers a complete introduction to cutting edge functional imaging in neuroradiology, including the physical principles and clinical applications of these advanced techniques. This book contains 49 chapters and is divided into nine major sections.

These sections include a review of the physical principles of all key functional techniques. Lesion characterization is presented using diffusion, perfusion, permeability, MR spectroscopy, and positron emission tomography. There is an overview of BOLD fMRI physical principles and key concepts, including scanning methodologies; experimental research design; data analysis; neurovascular uncoupling and functional connectivity. After characterization of a lesion, the book follows the clinical path of localizing eloquent cortex and white matter using BOLD fMRI and DTI as part of a presurgical mapping procedure. Current and future clinical applications of BOLD fMRI in neurosurgery, neurology, psychiatry, neuropsychology, and neuropharmacology are also presented. There is an indepth review of multimodality functional imaging that follows an algorithmic approach to brain lesion characterization as well as additional chapters on common brain abnormalities such as epilepsy, traumatic brain injury, and demyelinating disease. A section on imaging techniques that are not based on proton imaging is also presented and it includes magnetoencephalography; positron emission tomography; molecular imaging; and metabolic imaging. This is followed by a section on DTI and BOLD fMRI of the spine and cerebral spinal fluid flow imaging. Finally, a full-color neuroanatomical brain atlas of eloquent cortex and key white matter tracts and a review of BOLD fMRI paradigms are presented.

The field of functional neuroradiology is young. There is a great interest and need to continue to advance this area of radiology. Functional neuroradiology represents a vital subspecialty with important clinical applications and great opportunities for clinical and cognitive

neuroscience research. It is our hope that this book will give a thorough introduction to this new field and will be a reference, to all physicians and cognitive neuroscientists, of the current and emerging clinical applications of functional neuroradiology.

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