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Functional Neuroradiology: Principles and Clinical Applications

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Over the past 2 decades, the term *functional MR imaging* has come to imply the imaging of neuronal activity, also known as brain mapping. Because of the complex biophysical and physiologic origin of the signal and its predominant use within the basic neurosciences, it has yet to make a significant impact clinically. The increasing availability of complementary physiologic measurements such as regional cerebral blood flow and volume helps to provide functional MR imaging with the adjunct measures that are required for proper interpretation in a clinical setting. Functional neuroradiology represents a relatively new and ever-growing vital subspecialty with important clinical applications and a great opportunity for clinical and cognitive neuroscience research. There is great interest in continuing to advance this area of radiology to better our understanding of the physiologic processes of central nervous system diseases.

This book, written by 96 internationally distinguished neuroradiologists, neurologists, psychiatrists, cognitive neuroscientists, and physicists, is a comprehensive review of cutting-edge functional imaging in neuroradiology, including the physical principles and clinical applications of advanced technologies such as diffusion imaging, perfusion imaging, permeability imaging, MR spectroscopy, PET, blood oxygenation level–dependent (BOLD) MR imaging, and diffusion tensor imaging.

The 49 chapters are grouped into 9 major parts. Part 1, with 7 chapters, deals with imaging of diffusion, perfusion, permeability, and arterial spin labeling, as well as applications in stroke. Part 2 discusses MR spectroscopy, and part 3 demonstrates multimodality functional imaging of brain masses, epilepsy, brain injury, multiple sclerosis, psychiatric diseases, and pain. Part 4 discusses principles and methods of BOLD functional MR imaging, and part 5 reviews clinical applications of BOLD functional MR imaging in language systems, aging, cognitive impair, Wada testing, the visual pathway, mapping for brain surgery, pediatric cases, auditory systems, epilepsy, psychiatry, neurodegenerative diseases, psychopharmacology, and cognitive disorders. Part 6 handles diffusion tensor imaging in white matter and epilepsy, as well as complementary functional MR imaging. Part 7 discusses magnetoencephalography, PET/CT/MR imaging, molecular imaging, and metabolic MR imaging. Part 8 presents functional imaging of the spinal cord, cerebrospinal fluid, and hydrocephalus. Part 9 concludes the book with a full-color neuroanatomic brain atlas of eloquent cortex and key white matter tracts and a review of functional MR imaging paradigms.

This book offers a complete overview of functional imaging modalities and techniques used in diagnosis and patient management, as well as in emerging technology. As a reference on the current and emerging clinical applications of functional neuroradiology, the book will be useful for all neuroscientists and all physicians, especially radiologists, neurologists, neurosurgeons, and psychiatrists.

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