

## **PET and SPECT in Psychiatry**

R.A.J.O. Diercks, A. Otte, E.F.J. de Vries, and A. van Waarde, eds.

*New York, NY: Springer, 2014, 849 pages, \$399.00*

This book aims to introduce PET and SPECT studies while helping readers better understand the gist of psychiatric disorders. Because PET and SPECT provide information on neurochemical transmission as well as on brain perfusion and metabolism, they have historically had a crucial role in disclosing neurobiology and developing psychiatric drugs. This book helped us grasp the current status of psychiatric neuroimaging studies and the future direction of their clinical use.

The first part of the book presents the basics of neuroimaging in psychiatry. The role of PET in psychiatric drug development is introduced, and microdosing pharmacokinetics, receptor occupancy, and imaging biomarkers are explained. PET microdosing for new-radioligand development was recently introduced and requires a profound understanding of tracer kinetics and PET quantification ranging from compartment modeling of bolus infusions to neurotransmitter level monitoring and comparison studies with microdialysis. The book explains the importance of measuring neurochemicals that can be manipulated by pharmacologic and neurologic interventions. The book's presentation of the story of P-glycoprotein is another merit because of the role P-glycoprotein has had in slowing the development of brain radiochemicals.

Parts 2–6 present the use of PET and SPECT studies for specific psychiatric disorders. Part 2 includes comprehensive reviews of neuroimaging for depressive disorders, categorized as studies of metabolism/blood flow, neurochemical serotonin systems, dopamine and monoamine oxidase, and depression, including late-life depression, suicide attempts, and seasonal depression. There is also a focus on the use of PET and SPECT in such psychiatric problems as depression observed in dementia disorders and Parkinson disease. Part 3 introduces anxiety disorders. The chapters summarize well the alteration in neurotransmission while explaining the pharmacologic and pathophysiologic background.

The remainder of the book presents PET and SPECT findings in psychosis, particularly schizophrenia and delirium. Too few studies are described to elucidate any pathophysiologic implications. Nevertheless, despite the small number of studies, these chapters may still benefit the reader. The PET and SPECT studies on personality disorders are comprehensive, and the section on the use of PET and SPECT in drug addiction covers both preclinical and clinical studies as well as the neurobiologic background of addiction. In addition, in the same chapter one can find a clinical overview of impulsivity and a description of how we can image impulsivity by targeting neurotransmission. For obsessive readers such as us who reach the final pages of the book, the last chapter is a great joy. It explains the significant changes that can occur in neuroimages due to alterations in brain metabolism and neurochemicals

brought about by such interventions as neurostimulation, behavior therapy, and surgical treatment.

The contents of several chapters overlap. A detailed review of the neuroimaging of behavioral and psychologic symptoms of dementia would have improved the book, as would an initially presented general description of dementia. PET studies should have been better explained, considering their clinical importance in schizophrenia, including their use to define endophenotypes.

Studying the neurobiology and pathophysiology of psychiatric disorders is difficult because of their complexity and uniqueness. This book will certainly provide readers with a chance to better understand how functional neuroimaging studies can be used to answer fundamental questions about psychiatric diseases.

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## **PET and SPECT in Neurology**

R.A.J.O. Diercks, A. Otte, E.F.J. de Vries, and A. van Waarde, eds.

*New York, NY: Springer, 2014, 1,112 pages, \$399*

*PET and SPECT in Neurology* consists of 2 major sections. The first (part 1) covers the basics of using PET and SPECT to describe brain function and deals with tracer kinetics and quantification methods. In anticipation of the potential future clinical use of PET/MR imaging in neurology, the book also presents the use of MR techniques to examine blood flow, metabolism, and neuronal transmission. One can even find a description of the default-mode brain network on resting-state functional MR imaging, as well as interpretations in terms of the functional, structural, and metabolic networks.

In the second section of the book (parts 2–8), the clinical application and current status of using PET and SPECT imaging in several neurologic disorders are described, including dementia, cerebrovascular disorders, movement disorders, inflammation, epilepsy, and brain tumors. The clinical application of <sup>18</sup>F-FDG and amyloid PET in dementia, and of dopamine transporter SPECT in movement disorders, are reviewed excellently in textbook fashion. The current knowledge on these topics is nothing new, but the information is strongly recommended for beginners in PET and SPECT who want to thoroughly and systematically learn the present status of these imaging techniques in neurology.

Besides covering PET and SPECT findings for Alzheimer disease and mild cognitive impairment, the book appropriately emphasizes PET and SPECT findings for vascular dementia. Associated MR

findings are also described well, such as the white matter hyperintensity that can reflect microvascular injuries and thus explain dementia or cognitive impairment. Readers are also presented with the cerebrovascular risk factors for Alzheimer disease, as well as the tantalizing topic of the differential contribution of vascular and degenerative processes to a patient's dementia. Readers will be led to ponder the sensitivity of this topic because of the fuzzy boundary between Alzheimer disease and subcortical vascular dementia. We might refine the PET and SPECT studies introduced in this book for possible use in discriminating or characterizing various conditions.

A few types of receptor PET are introduced, including imaging of the nicotinic acetylcholine receptor system and of inflammation in dementia. Considering the importance of inflammation in neurodegenerative and neuropsychiatric illnesses, the emphasis on neuroinflammation PET of microglial activation is appropriate. However, in another chapter, use of the different name of translocator protein PET/SPECT to describe the same technique for multiple sclerosis is annoying. In contrast, the decision to deal with carotid artery imaging of inflammation and atherosclerosis separately in 2 chapters is appealing. The book covers the most common study for imaging of carotid vulnerability in the clinic— $^{18}\text{F}$ -FDG PET—as well as introducing experimental or preclinical imaging of lipid accumulation, imaging of thrombosis, and angiogenesis imaging related to carotid atherosclerotic plaque. These topics seem sufficient to attract physicians' interest.

The epilepsy studies in this book focus on novel PET ligands showing  $\gamma$ -aminobutyric acid-ergic transmission, serotonergic or opioid transmission, and P-glycoprotein 1. The listed functional PET studies have interesting findings in disclosing the pathophysiology of epilepsy and promise the future use of PET and SPECT in the development of antiepileptic drugs.

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## **PET and SPECT of Neurobiological Systems**

R.A.J.O. Diercks, A. Otte, E.F.J. de Vries, and A. van Waarde, eds.

*New York, NY: Springer, 2014, 818 pages, \$399.00*

This book contains information mainly on up-to-date PET and SPECT studies of pathologic markers and radiotracers targeting neurotransmitters and their possible clinical uses, as well as detailing the enormous recent progress in molecular neurobiology. Because of the excellent organization of the chapters, neuroscientists will easily locate their systems of interests and physicians will quickly locate up-to-date information on molecular imaging of specific brain disorders.

The organization of the book is according to the targeting molecules in neurobiologic systems. The first part presents the

basics of PET and SPECT imaging while focusing more on preclinical studies. Starting with animal models of neurologic and psychiatric disorders, the fundamentals of small-animal PET and SPECT systems and protocols are covered. Emphasizing the capabilities of quantitation using PET and SPECT, this part is of the greatest help to readers who deal with animal studies. The last chapter in this part of the book describes the influence of genetic polymorphism on PET and SPECT studies of several neuroreceptor molecules.

The second part covers PET and SPECT imaging of specific systems. Except for Chapter 8, which presents PET tracers for  $\beta$ -amyloid and other proteinopathies, all the chapters cover specific neuroreceptors, transporters, or neurotransmitters. Each chapter introduces the biologic function of neurotransmitter systems and presents specific radioligands followed by preclinical/clinical studies. Detailed reviews of each system will be useful and attractive to any researcher studying specific systems. To explain why and how several radiotracers have been developed for each system, a portion of most chapters is devoted to a detailed introduction of each system and the related radiopharmaceuticals. For example, the chapter on the endocannabinoid system introduces the physiology of cannabinoid receptors in a concise and easy-to-understand manner and their related neuropsychiatric pathologies. After presenting radioligands for cannabinoid receptor subtypes, the chapter emphasizes current imaging studies and potential applications. Despite the holistic nature of the reviews for each system, the contents of the various chapters do not lose consistency and look well organized.

The chapter on the dopamine system briefly presents the radioligands and imaging studies. Considering that this system has been the most actively studied, we expected a better description. The description of clinical uses and outcomes in movement disorders—and the studies and findings on receptor occupancy—are insufficient. One chapter deals with central benzodiazepine receptors. It presents their possible usefulness in chronic cerebral ischemia, skipping other applications such as epilepsy. Other chapters, such as that on nicotinic acetylcholine receptor imaging, present a comprehensive summary of knowledge on previously released radiopharmaceuticals and their image findings, followed by up-to-date disease applications. The chapter on opioid receptor imaging presents the historical development and current wide use of a radioligand.

This book accomplished a job that is never easy. The authors describe most of the preclinical studies and include updated information on the development of radiotracers for every neurobiologic system. They rarely deal with the fundamentals of the kinetics for each tracer or with radiochemistry issues, especially for the neuroreceptors. If readers plan to develop a new tracer to target neurotransmitter systems or to find its application, reference to the relevant chapters will be a helpful starter to acquiring well-rounded knowledge in a specific scientific field within a reasonable time.

The editors have done an excellent job on this entire series of books. We envy their success at benefiting future readers.

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