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### **In Re: Brain Imaging in Substance Abuse. *Research, Clinical and Forensic Applications* Edited by**

Marc J. Kaufman

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### **In Re: Brain Imaging in Substance Abuse. *Research, Clinical and Forensic Applications***

Edited by Marc J. Kaufman, Totowa, NJ: Humana Press; 2001 (\$125)

*Brain Imaging in Substance Abuse* is composed of eight chapters, a total of 425 pages. Text related to imaging in substance abuse occupies just over half of the volume, with the remainder of the textbook (pp 249–425) devoted to the glossary, extensive bibliography, and index. Abused substances discussed include alcohol, marijuana, hallucinogens, benzodiazepines, heroin and opiates, cocaine, amphetamines, and solvents. Polydrug abuse is also addressed. Various authors have written chapters in their areas of expertise. Most of the authors are from the field of psychiatry and affiliated with Harvard Medical School and the Brain Imaging Center or Behavioral Psychopharmacology Research Laboratory at McLean Hospital in Belmont, Massachusetts. Interestingly, none of the chapters are written by or in conjunction with radiologists or neuroradiologists.

The stated intent of the editor, as outlined in the preface, is to describe the methods and review the research findings of the imaging techniques most often used in the field of substance abuse. To this end, the first three chapters of the book are devoted to the techniques and fundamentals of EEG, positron emission tomography (PET)/single-photon emission CT (SPECT), and MR, respectively, while chapters 4 through 6 are devoted to the application of these techniques as they relate to substance abuse. Chapter 7 discusses neuropsychology, whereas chapter 8 ends with the role of substance abuse imaging as legal evidence.

Chapter 1 on EEG technique is interesting and well written. The information is basic and understandable. The importance of EEG in evaluating brain electrical activity, particularly with respect to substance abuse, is emphasized. The authors address the uses and limitations of both EEG and event-related potentials. The text is complemented by nine figures that keep a radiologist's attention.

Chapters 2 and 3 describe the technical foundations for PET/SPECT and MR respectfully. The chapters were to be written so that "readers with nontechnical backgrounds will be able to appreciate how these technologies work". The chapter on PET/SPECT accomplishes this goal. The reader should develop a basic understanding of the technical background of these techniques. Subjects discussed in chapter 2 include evaluation of neuronal activity via glucose metabolism and cerebral blood flow as well as the evaluation of brain chemistry via neurotransmitter receptors and transporters. This chapter provides a good basic understanding of the extensive use of these nuclear medicine techniques in substance abuse imaging.

Chapter 3, on the fundamentals of MR, attempts to discuss the history and basic physics of MR im-

aging in 1.5 pages. Many technical terms are not defined in this brief explanation. This section would only be comprehensible to a reader who already has a background in physics or MR imaging. Even then, the section is confusing. Much more detail would be needed for anyone with a radiology background, including residents and fellows. Specific contraindications regarding MR imaging are discussed that may lead to increased awareness among clinicians regarding these issues. Sections on MR spectroscopy and blood oxygenation level-dependent functional MR imaging provide the basics, are understandable, and provide a good baseline for understanding imaging findings discussed in chapter 6. Small sections touch on perfusion, diffusion, MR angiography, and magnetization transfer that are discussed very little in further chapters. In summary, this chapter is confusing and too short for the nontechnical readers and too brief for radiologists who are better left with traditional sources.

Chapters 4 through 7, relating to imaging findings and the neuropsychology correlates of substance abuse, are arranged in a very orderly fashion, are uniform from chapter to chapter, and are well outlined in the table of contents. Information is arranged by drug of abuse with acute effects of the drug followed by chronic effects. Findings related to withdrawal, craving, abstinence, and relapse then follow, when appropriate, to the research for that substance.

Chapter 4 discusses EEG findings in substance abuse. The text is interesting, readable, and well organized. There are several locations where findings related to auditory brain stem response and evoked potentials are discussed. These techniques are not previously described and, as a radiologist, I found this information difficult to understand. Under the heading *Electroencephalographic Studies of Chronic Abusers*, the author discusses the inherent difficulties in both research methods and interpretation of neuroimaging studies in chronic substance abuse. This discussion is excellent and pertains to all imaging modalities. It is unfortunate that this topic by its own merit cannot be found in the table of contents and perhaps this discussion should have been placed in a more conspicuous location relevant to all chapters. The last section on neuroimaging research discusses EEG with respect to the other more expensive technologies and its continued role in the future, a topic both interesting and informative.

Chapter 5 evaluates the use of both PET and SPECT in neuroimaging of substance abuse. There are five figures and seven color plates that appeal to the eye of the radiologist. Imaging with respect

to cerebral blood flow, glucose metabolism, withdrawal, and craving are discussed. Abstinence, receptor studies, and treatment effects are also addressed. The information provided is interesting, but has little relevance to a radiologist or neuro-radiologist unless the reader is specifically interested in research in this arena. Many references are cited in this chapter, which should serve as a good source when needed.

Chapter 6 discusses MR imaging, MR spectroscopy, and functional MR imaging findings in substance abuse. The chapter is a review of the literature with a section devoted to special syndromes associated with alcohol abuse. A dedicated image for each syndrome would have been more thorough. There is a comprehensive table outlining MR studies in alcohol abuse patients with findings related to ventricular and sulcal volume, gray and white matter volume, as well as functional findings. As a radiologist, however, I am quick to find small errors in the description of imaging findings as written by a psychiatry author. When describing MR abnormalities, more detail than "thalamic abnormalities" and "abnormal pontine signals" is expected. The radiologist may also be quick to find error in describing an abnormality on MR images as "hypodense or hyperdense" or an old infarct on a T1-weighted images described as a "dark spot". As radiologists, we often make these errors, but they should have been corrected upon editing. There are good subsections on the prenatal effects of alcohol and cocaine that document and reference sources for possible medicolegal purposes. This chapter is best used as a reference, particularly when researching a particular substance of abuse.

Chapter 7 discusses the neuropsychological correlates of substance abuse and is well organized and interesting reading. The information, however,

has little relevance to radiology other than to the reader who has an interest in correlating the neuropsychological profile of a specific drug with its neuroimaging findings.

Chapter 8, *Neuroimaging as Legal Evidence*, mainly addresses the use of neuroimaging by psychiatric expert witnesses and discusses the limited role these techniques should play. Although the authors are quick to point out the usefulness of imaging abnormalities on a structural basis such as those found in child abuse, trauma, or brain death, the use of imaging to diagnose psychiatric or cognitive abnormalities is not supported. The chapter is very interesting, discusses the fundamental differences between legal and scientific methods, and the legal standards for expert scientific testimony.

The bibliography is perhaps the most valuable section of the book. There are over 1350 references arranged by imaging modality and substance of abuse. The bibliography contains an introduction as well as a complete table of contents.

In summary, the book is a current review of the substance abuse literature, with a valuable, extensive, and well-organized bibliography. The basics of EEG and PET/SPECT are brief and understandable while the basics of MR imaging are best left to traditional sources. Coverage of application of neuroimaging techniques in substance abuse is complete. Findings in all modalities are most applicable to the reader who is specifically interested in an imaging technique or abused drug or the reader who is involved in substance abuse research. I would not recommend the book to residents or fellows in radiology or neuroradiology nor would I recommend this text as a standard book on radiologists' shelves. The book best serves as a complete reference on neuroimaging in substance abuse purchased by a library.