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Review: The use of functional magnetic resonance imaging (fMRI) in clinical trials and experimental research studies for depression

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Functional magnetic resonance imaging (fMRI) is a non-invasive technique that can be used to examine neural responses with and without the use of a functional task. Indeed, fMRI has been used in clinical trials and pharmacological research studies. In mental health, it has been used to identify brain areas linked to specific symptoms but also has the potential to help identify possible treatment targets. Despite fMRI's many advantages, such findings are rarely the primary outcome measure in clinical trials or research studies. This article reviews fMRI studies in depression that sought to assess the efficacy and mechanism of action of compounds with antidepressant effects. Our search results focused on selective serotonin reuptake inhibitors (SSRIs), the most commonly prescribed treatments for depression and ketamine, a fast-acting antidepressant treatment. Normalization of amygdala hyperactivity in response to negative emotional stimuli was found to underlie successful treatment response to SSRIs as well as ketamine, indicating a potential common pathway for both conventional and fast-acting antidepressants. Ketamine's rapid antidepressant effects make it a particularly useful compound for studying depression with fMRI; its effects on brain activity and connectivity trended toward normalizing the increases and decreases in brain activity and connectivity associated with depression. These findings highlight the considerable promise of fMRI as a tool for identifying treatment targets in depression. However, additional studies with improved methodology and study design are needed before fMRI findings can be translated into meaningful clinical outcomes.

KEYWORDS

functional magnetic resonance imaging (fMRI), depression, clinical trial, selective serotonin reuptake inhibitor (SSRI), ketamine, amygdala

1. Introduction

Functional magnetic resonance imaging (fMRI) is a commonly-used, non-invasive technique used to study the living human brain. fMRI refers to the acquisition of data modulated with extrinsic (e.g., task stimulus) stimuli or allowed to follow intrinsic fluctuations (e.g., thought). It is typically conducted using blood oxygen level dependent (BOLD) sensitivity methods—such as resting-state and task-based fMRI.

Magnetic Resonance In Experimental And Clinical Oncology

**Osman Ratib, Markus
Schwaiger, Thomas Beyer**



Magnetic Resonance In Experimental And Clinical Oncology:

Magnetic Resonance in Experimental and Clinical Oncology Jeffrey L. Evelhoch, 1990-10-31 Proceedings of the 21st Annual Detroit Cancer Symposium Detroit Michigan April 13 14 1989 *Magnetic Resonance in Experimental and Clinical Oncology* Jeffrey L. Evelhoch, William Negendank, Frederick A. Valeriote, 1990-10-31 **Magnetic Resonance in Experimental and Clinical Oncology** Jeffrey L. Evelhoch, William Negendank, Frederick A. Valeriote, Laurence H. Baker, 1990-10-31 Over the past decade techniques have been developed and implemented to observe metabolism noninvasively in localized regions of intact living experimental animals and humans through the use of magnetic resonance spectroscopy MRS At the same time magnetic resonance imaging MRI techniques developed in the 1970s and refined in this decade have been increasingly applied as a powerful clinical tool to probe human anatomy Because of the unusual metabolic and physiologic characteristics of malignant tissues oncology has been one of the primary focuses of the application of both MRS and MRI Although considerable progress has been made in oncologic applications of magnetic resonance MR further research is needed to realize the full potential of MR in this area Consequently the 21st Annual Detroit Cancer Symposium entitled Magnetic Resonance in Experimental and Clinical Oncology was organized to provide a forum for researchers in the field to report the state of the art of MRS and MRI in oncology to discuss future goals for MRS and MRI in oncology and to define the research needed to meet those goals The major emphasis of the symposium was on MRS due to both the recent widespread availability of clinical MRS instrumentation and the extensive amount of animal MRS research performed over the past half decade **Chemopotential by Hyperthermia** M. Urano, E. Douple, 1994-04 The number of studies on the use of hyperthermia in combination with chemotherapeutic agents is steadily increasing However thermochemotherapy has not yet captured significant clinical interest Therefore this fourth volume in the book series Hyperthermia and Oncology deals with this topic as the editors feel there is a significant potential for this combined modality as an adjuvant to palliative or definitive radiotherapy or the use of chemotherapy alone to treat localized or advanced diseases The articles in this volume deal with various aspects of chemotherapy combined with hyperthermia and will be of value and interest to researchers in this field *Congress Proceedings* William C. Dewey, Martha Edington, Michael Fry, 2013-10-02 Congress Proceedings *Eicosanoids and Other Bioactive Lipids in Cancer and Radiation Injury* Kenneth V. Honn, Lawrence J. Marnett, Santosh Nigam, Thomas Walden Jr., 2012-12-06 This volume contains the proceedings of the First International Conference on Eicosanoids and Other Bioactive Lipids in Cancer and Radiation Injury held in Detroit Michigan on October 11 14 1989 The program consisted of 83 oral and 29 poster presentations 74 of which are included in these proceedings The major sponsors of the conference were the Armed Forces Radiobiology Research Institute located in Bethesda Maryland the Radiation Oncology Research and Development Center of the Gershenson Radiation Oncology Center Harper Hospital in Detroit Michigan and Schering AG of West Germany Eighteen other organizations provided additional support The

conference was unique in its attempt to link the eicosanoid and lipid researchers in the radiobiology and cancer disciplines. The diverse roles that eicosanoids and other bioactive lipids play in these biological phenomena including the participation of lipid oxidation in conversion of procarcinogens, positive and negative modulation of tumor growth, immunomodulation, tissue injury and yet protection and enhancement of cancer therapy necessitated scientific interaction to sort out and understand these complex and sometimes contradictory observations. The success of this effort is reflected not only through these proceedings but also through the decision to continue the conference series with a second meeting to be held in Berlin between September 17-21, 1991.

Dynamic Contrast-Enhanced Magnetic Resonance Imaging in Oncology Alan

Jackson, David L. Buckley, Geoffrey J. M. Parker, 2005-11-02. Dynamic contrast enhanced MRI is now established as the methodology of choice for the assessment of tumor microcirculation in vivo. This is assisting clinical practitioners in the management of patients with solid tumors and is finding prominence in the assessment of tumor treatments including anti-angiogenics, chemotherapy and radiotherapy. In this book targeted at both clinical practitioners and basic scientists, the principles of the methods, their practical implementation and their application to specific tumor types are discussed by the leading authorities in the field today. The book will serve as an invaluable single volume reference covering all the latest developments in contrast enhanced oncological MRI. Journal of the National Cancer Institute, 1991.

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National Library of Medicine (U.S.), 1982. First multi year cumulation covers six years 1965-70. *Cancer Imaging* M. A.

Hayat, 2007-11-21. This second of two volumes on Cancer Imaging covers the three major topics of imaging instrumentation, general imaging applications and imaging of a number of human cancer types. Where the first volume emphasized lung and breast carcinomas, Volume 2 focuses on prostate, colorectal, ovarian, gastrointestinal and bone cancers. Although cancer therapy is not the main subject of this series, the crucial role of imaging in selecting the type of therapy and its post treatment assessment are discussed. The major emphasis in this volume is on cancer imaging; however, differentiation between benign tumors and malignant tumors is also discussed. This volume is sold individually and *Cancer Imaging Volume 1* ISBN 978 0 12 370468 9 sells separately for 189 and also as part of a two volume set ISBN 978 0 12 374212 4 for 299. Concentrates on the application of imaging technology to the diagnosis and prognosis of prostate, colorectal, ovarian, gastrointestinal and bone cancers. Addresses relationship between radiation dose and image quality. Discusses the role of molecular imaging in identifying changes for the emergence and progression of cancer at the cellular and/or molecular levels. Cytotoxic

Anticancer Drugs: Models and Concepts for Drug Discovery and Development Frederick A. Valeriote, Thomas H.

Corbett, Laurence H. Baker, 2012-12-06. The focus of the 22nd Annual Detroit Cancer Symposium was the presentation and discussion of cytotoxic agents with a significant portion of the symposium including the exciting frontiers of drug discovery being explored by the National Cooperative Drug Discovery Groups (NCDDG) Program. The symposium brought together a large number of investigators from government, universities and pharmaceutical companies involved in the discovery and

development of new anticancer agents Exciting new leads were presented and the status of others presently under development was discussed Of particular significance has been the initiation of renewed efforts in the area of natural product drug discovery where the discovery of new cytotoxics is very promising at the moment A number of major changes have occurred during the last decade in research on drug discovery of cytotoxic agents Critical reviews of a number of the models and concepts underlying drug discovery represented a continuous thread throughout the meeting being constantly discussed in terms of their advantages disadvantages and capabilities of discovering solid tumor active anticancer agents A recent development which is to be much applauded and which portends to great discoveries is the new relationship formed between Government University of Industry The NCDDG mechanism which stimulates this interaction in an inexpensive manner to greatly magnify the drug discovery and development effort nationally Cytotoxic Anticancer Drugs Models and Concepts for Drug Discovery and Development represents a forum which will become the major mode for bringing together these three different components in the equation to regularly discuss new results and ideas

Nanoneuroscience and Nanoneuropharmacology Hari S. Sharma, 2009-12-03 This volume presents articles from the leading experts in the field in nanobiotechnology providing students and researchers with a comprehensive review of the newly emerging area of neuroscience All aspects of nanomaterials induced alteration in brain function are considered Basic chapters on methods and ways to enhance nano drug delivery into the brain are presented as well as chapters on functional and structural changes in the CNS including gene expression and related issues Particular attention is given to possible therapeutic advancement regarding nano drug formulation and their role in neuroprotection

Anticancer Research, 1996

Comprehensive Biomedical Physics, 2014-07-25 Comprehensive Biomedical Physics Ten Volume Set is a new reference work that provides the first point of entry to the literature for all scientists interested in biomedical physics It is of particularly use for graduate and postgraduate students in the areas of medical biophysics This Work is indispensable to all serious readers in this interdisciplinary area where physics is applied in medicine and biology Written by leading scientists who have evaluated and summarized the most important methods principles technologies and data within the field Comprehensive Biomedical Physics is a vital addition to the reference libraries of those working within the areas of medical imaging radiation sources detectors biology safety and therapy physiology and pharmacology as well as in the treatment of different clinical conditions and bioinformatics This Work will be valuable to students working in all aspect of medical biophysics including medical imaging and biomedical radiation science and therapy physiology pharmacology and treatment of clinical conditions and bioinformatics The most comprehensive work on biomedical physics ever published Covers one of the fastest growing areas in the physical sciences including interdisciplinary areas ranging from advanced nuclear physics and quantum mechanics through mathematics to molecular biology and medicine Contains 1800 illustrations all in full color

Atlas of PET/MR Imaging in Oncology Osman Ratib, Markus Schwaiger, Thomas Beyer, 2013-05-17 This new project on PET MR imaging in

oncology includes digital interactive software matching the cases in the book The interactive version of the atlas is based on the latest web standard HTML5 ensuring compatibility with any computer operating system as well as a dedicated version for Apple iPad The book opens with an introduction to the principles of hybrid imaging that pays particular attention to PET MR imaging and standard PET MR acquisition protocols A wide range of illustrated clinical case reports are then presented Each case study includes a short clinical history findings and teaching points followed by illustrations legends and comments The multimedia version of the book includes dynamic movies that allow the reader to browse through series of rotating 3D images MIP or volume rendered display blending between PET and MR and dynamic visualization of 3D image volumes The movies can be played either continuously or sequentially for better exploration of sets of images The editors of this state of the art publication are key opinion leaders in the field of multimodality imaging Professor Osman Ratib Geneva and Professor Markus Schwaiger Munich were the first in Europe to initiate the clinical adoption of PET MR imaging Professor Thomas Beyer Zurich is an internationally renowned pioneering physicist in the field of hybrid imaging Individual clinical cases presented in this book are co authored by leading international radiologists and nuclear physicians experts in the use of PET and MRI

[In Vivo Imaging of Cancer Therapy](#) Anthony F. Shields,Pat Price,2007-12-06 Imaging studies are frequently used to evaluate the success of cancer treatments for a variety of tumor types In Vivo Imaging of Cancer Therapy addresses a variety of cutting edge imaging techniques including their use for best practice and provides examples of results found in both pre clinical and clinical studies This comprehensive text covers the entire spectrum of in vivo imaging for oncology including current approaches to detailed anatomic measurements MR and optical spectroscopy and molecular imaging techniques requiring exogenously administered imaging agents The challenges and approaches to quantification are also outlined The authors describe technologies and methods that are currently clinically available and many that are still in a developmental stage or useful only in animal studies However it is important to realize that the majority of imaging devices now offered for sale by the major imaging equipment manufacturers did not exist as recently as 3 or 4 years ago Thus the pace of technology development is such that techniques described here as laboratory or investigational will likely be in clinical use within a few years In vivo imaging will continue to have profound effects on how we think about detect diagnose treat and monitor cancer In Vivo Imaging of Cancer Therapy will aide clinicians at all levels in keeping up with the most cutting edge techniques

[Computed Tomography & Magnetic Resonance Imaging Of The Whole Body E-Book](#) John R. Haaga,Daniel Boll,2016-06-06 Now more streamlined and focused than ever before the 6th edition of CT and MRI of the Whole Body is a definitive reference that provides you with an enhanced understanding of advances in CT and MR imaging delivered by a new team of international associate editors Perfect for radiologists who need a comprehensive reference while working on difficult cases it presents a complete yet concise overview of imaging applications findings and interpretation in every anatomic area The new edition of this classic reference released in its 40th year in print is a must have resource now

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