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

Vasileia Kotoula^{*,†}, Jennifer W. Evans[†], Claire E. Punturieri and
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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

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Magnetic Resonance in Experimental and Clinical Oncology Jeffrey L. Evelhoch, William Negendank, Frederick A. Valeriote, Laurence H. Baker, 2012-12-06 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

Magnetic Resonance in Experimental and Clinical Oncology Jeffrey L. Evelhoch, William Negendank, Frederick A. Valeriote, 1990-10-31

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Chemopotentialiation 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

Journal of the National Cancer Institute, 2006-05 Each issue is packed with extensive news about important cancer related science policy politics and people Plus there are editorials and reviews by experts in the field book reviews and commentary on timely topics

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

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 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 **Anticancer Research**, 1996 Current Catalog National Library of Medicine (U.S.), 1993 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

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 **Radiation Research: Congress proceedings** William C. Dewey, 1992 **The Tohoku Journal of Experimental Medicine**, 1993 Central Nervous System Metastasis, the Biological Basis and Clinical Considerations Diane Palmieri, 2012-12-30 This volume will cover what is known regarding the biology and treatment of CNS metastasis including novel chapters such as the future of targeted therapies It will begin with an overview of the natural history and risk factors for CNS metastases that will broadly cover all cancer histologies This will be followed by 3 chapters that will cover the biology These include molecular biology discussing what is known about specific genes proteins involved in the process and model systems to study brain metastasis

the brain microenvironment focusing on how it is different from the microenvironment of other organs of the body and the blood brain barrier which includes a discussion of permeability with respect to brain metastases A chapter on experimental imaging will cover both the biology of brain metastasis from an imaging perspective and use of imaging techniques to study brain metastases The clinical chapters will discuss treatment options with separate chapters on surgery chemotherapy and radiation In addition leptomeningeal metastasis will be given its own chapter Finally quality of life issues will be the concluding chapter

Cumulated Index Medicus ,1986

Clinical PET/MRI Onofrio Antonio Catalano,2022-09-07

Clinical PET MR presents the state of the art of PET MR guiding the reader from how to scan patients how to read and report the studies and how keep an eye on what is clinically relevant for a patient s care Each chapter starts with the clinical scenario and then moves to pertinent imaging addressing the need of a clinical PET MR book written by world experts in both clinical and imaging fields It discusses the clinical application of PET MR in diverse subspecialties such as head and neck neurology cardiovascular pediatrics chest bone hematology breast hepatobiliary pancreatic genitourinary gynecology and gastrointestinal tract This book is a valuable resource for radiologists oncologists and members of the biomedical field who need to learn more about clinical applications of PET MR Presents a description of robust acquisition protocols to teach readers how to scan PET MR patients from tracers to sequences Provides a clinical background section in each chapter to help readers focus on the real clinical issues that need to be addressed in the medical report Written by world authorities in the field in a didactic manner to describe the real status of imaging

Subject Index of Current Extramural Research

Administered by the National Cancer Institute ,1978

Cancer Nursing Connie Yarbrow,Debra Wujcik,Barbara Holmes

Gobel,2011 A new and revised version of this best selling reference For over eighteen years best selling Cancer Nursing Principles and Practice has provided oncology nurses with the latest information on new trends in the rapidly changing science of oncology Now in its Seventh Edition Cancer Nursing has been completely revised and updated to reflect key new developments New topics covered include targeted therapy hypersensitivity reactions mucositis and family and caregiver issues With 27 new chapters featuring insights from key authors the Seventh Edition is a must have resource for every oncology nurse

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