
Clinicians' Guides to Radionuclide Hybrid Imaging

PET/CT

Series Editors

Jamshed B. Bomanji
London, UK

Gopinath Gnanasegaran
London, UK

Stefano Fanti
Bologna, Italy

Homer A. Macapinlac
Houston, Texas, USA

More information about this series at <http://www.springernature.com/series/13803>

Sobhan Vinjamuri
Editor

PET/CT in Thyroid Cancer

 Springer

 **BNMS**
BRITISH NUCLEAR MEDICINE SOCIETY

Editor
Sobhan Vinjamuri
Department of Nuclear Medicine
Royal Liverpool and Broadgreen University
Hospitals NHS Trust
Liverpool
UK

ISSN 2367-2439 ISSN 2367-2447 (electronic)
Clinicians' Guides to Radionuclide Hybrid Imaging - PET/CT
ISBN 978-3-319-71845-3 ISBN 978-3-319-71846-0 (eBook)
<https://doi.org/10.1007/978-3-319-71846-0>

Library of Congress Control Number: 2018930909

© Springer International Publishing AG, part of Springer Nature 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by the registered company Springer International Publishing AG part of Springer Nature

The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

*PET/CT series is dedicated to Prof Ignac
Fogelman, Dr Muriel Buxton-Thomas and
Prof Ajit K Padhy*

Foreword

Clear and concise clinical indications for PET/CT in the management of oncology patient are presented in this series of 15 separate booklets.

Early and accurate diagnosis, better staging, tailored management and specific treatment of cancer in patients have been achieved with the advent of this multimodality imaging technology. Clear information on treatment responses can be collected using PET/CT, as well as prognostic information, which can serve as a guide for additional therapeutic options.

PET/CT was fortunately able to derive a great benefit from radionuclide-labelled probes, which deliver often excellent target and non-target signals. Whilst labelled glucose remains the cornerstone for the clinical benefit achieved, a number of recent probes are definitely adding benefit. PET/CT is hence an evolving technology with extensive applications and indications. Significant advances in the instrumentation and data processing available have also contributed to this technology, which delivers a wealth of high-throughput data, is well tolerated by patients and indeed is accepted by patients and the public. As an example, the role of PET/CT in the evaluation of cardiac disease is also covered, with emphasis on labelled rubidium and labelled glucose studies.

The novel probes of labelled choline; labelled peptides, such as DOTATATE; and, most recently, labelled PSMA (prostate-specific membrane antigen) have gained rapid clinical utility and acceptance as significant PET/CT tools for the management of patients with neuroendocrine diseases and prostate cancer, notwithstanding all the advances achieved with other imaging modalities, such as MRI. Hence, a chapter reviewing novel PET tracers forms part of this series.

The oncological community has recognised the value of PET/CT and has delivered advanced diagnostic criteria for some of the most important indications for PET/CT. This includes the recent Deauville criteria for the classification of PET/CT patients with lymphoma, and similar criteria are expected to be developed for other malignancies, such as head and neck cancer, melanoma and pelvic malignancies. Finally, a separate section covers the role of PET/CT in radiotherapy planning, discussing the indications for planning biological tumour volumes in relevant cancers.

These booklets offer simple, rapid and concise guidelines on the utility of PET/CT in a range of oncological indications. They also deliver a rapid aide memoire on the merits and appropriate indications for PET/CT in oncology.

London, UK

Peter J. Ell, FMedSci, DR HC, AΩA

Preface

Hybrid imaging with PET/CT and SPECT/CT combines the best in function and structure to provide accurate localisation, characterisation and diagnosis. There is extensive literature and evidence to support PET/CT, which has made a significant impact in oncological imaging and management of patients with cancer. The evidence in favour of SPECT/CT especially in orthopaedic indications is evolving and increasing.

The *Clinicians' Guides to Radionuclide Hybrid Imaging* (PET/CT and SPECT/CT) pocketbook series is specifically aimed for referring clinicians, nuclear medicine/radiology doctors, radiographers/technologists and nurses who are routinely working in nuclear medicine and participate in multidisciplinary meetings. This series is a joint work of many friends and professionals from different nations who share a common dream and vision towards promoting and supporting nuclear medicine as a useful and important imaging speciality.

We want to thank all those people who have contributed to this work as advisors, authors and reviewers, without whom this book would not have been possible, and our members from the BNMS (British Nuclear Medicine Society, UK) for their encouragement and support. We are also extremely grateful to Dr. Brian Nielly, Charlotte Weston, the BNMS Education Committee and the BNMS council members for their enthusiasm and trust.

Finally, we wish to extend particular gratitude to the industry for their continuous supports towards education and training.

London, UK

Gopinath Gnanasegaran
Jamshed Bomanji

Acknowledgements

The series co-ordinators and editors would like to express sincere gratitude to the members of the British Nuclear Medicine Society, patients, teachers, colleagues, students, the industry and the BNMS Education Committee Members for their continued support and inspiration.

Andy Bradley
Brent Drake
Francis Sundram
James Ballinger
Parthiban Arumugam
Rizwan Syed
Sai Han
Vineet Prakash

Contents

1	Thyroid Cancer	1
	Susannah L. Shore	
2	Thyroid Cancer Pathology	9
	Susannah L. Shore	
3	Management of Thyroid Cancer	15
	M.P. Rowland, A.J. Waghorn, and S. Vinjamuri	
4	Radiological Imaging in Thyroid Cancer	25
	Rashika Fernando	
5	Radionuclide Imaging in Thyroid Cancer	35
	Emmanouil Panagiotidis	
6	¹⁸F-FDG PET/CT Normal Variants, Artefacts and Pitfalls in Thyroid Cancer	45
	Arun Sasikumar, Alexis Corrigan, Muhammad Umar Khan, and Gopinath Gnanasegaran	
7	Metabolic PET/CT Imaging in Thyroid Cancer	61
	Ioan Prata	
8	Benign and Malignant Thyroid Diseases on ¹⁸F FDG PET/CT: Pictorial Atlas	67
	Haseeb Ahmed and Hosahalli Mohan	
	Index	83

Contributors

Haseeb Ahmed Department of Nuclear Medicine, Guy's & St Thomas' NHS Foundation Trust, London, UK

Alexis Corrigan Consultant in Radionuclide Radiology, Maidstone Hospital, Maidstone, UK

Rashika Fernando Royal Liverpool and Broadgreen University Hospitals NHS Trust, London, UK

Gopinath Gnanasegaran Department of Nuclear Medicine, Royal Free London NHS Foundation Trust, London, UK

Muhammad Umar Khan Al-Jahra Hospital, Al-Jahra, Kuwait

Hosahalli Mohan Department of Nuclear Medicine, Guy's & St Thomas' NHS Foundation Trust, London, UK

Emmanouil Panagiotidis Department of Nuclear Medicine, Royal Liverpool University Hospital, Liverpool, UK

Ioan Prata Bradford Teaching Hospitals NHS Foundation Trust, Bradford, United Kingdom

M.P. Rowland Department of Surgery, Royal Liverpool University Hospital, Liverpool, UK

Arun Sasikumar Consultant and Head of the Department, Department of Nuclear Medicine, St Gregorios International Cancer Care Centre, Parumala, Kerala, India

Susannah L. Shore Royal Liverpool and Broadgreen University Hospitals NHS Trust, Liverpool, UK

Sobhan Vinjamuri Department of Nuclear Medicine, Royal Liverpool and Broadgreen University Hospitals NHS Trust, Liverpool, UK

A.J. Waghorn Department of Surgery, Royal Liverpool University Hospital, Liverpool, UK