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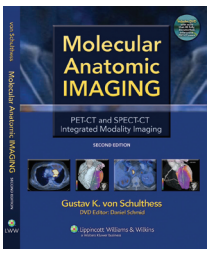
BOOK REVIEW

Molecular Anatomic Imaging: Pet-CT and SPECT-CT Integrated Modality Imaging

2nd Edition, 2007



Author: Gustav K. Von Schulthess (and over 70 contributors)
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التصوير التشريحي الجزيئي: وسيلة إدماج الصور بالتَّصْوير المَقْطَعِيّ المحوسَب بالإِصْدارِ البوزيترونيّ وبالفوتون الأحادي

تأليف: جوستاف فون شولتيز

This book is a revised edition of Clinical Molecular Anatomic Imaging (2003) by the same author. Since the publishing of the first edition, the importance of positron emission tomography (PET) and single photon emission tomography (SPECT) in the clinical arena has evolved achieving a definite place in the realm of clinical investigations of patients. PET is today recognized as the best tumour imaging modality by the scientific community worldwide while SPECT has almost completely replaced planar imaging in many nuclear medicine investigations. Although very sensitive compared to other imaging modalities, PET and SPECT lack the ability to define anatomical landmarks precisely. This book discusses how this shortfall is currently overcome by integrating PET and SPECT with computed tomography (CT). The combination with CT anatomical imaging with PET and SPECT functional/molecular imaging has revolutionised patient investigation. The addition of CT allows more accurate attenuation correction of the photons by overlying tissues and organs.

This edition is written in a style that makes it more useful to those in clinical practice rather than those interested in research into molecular imaging. The book is divided into 7 parts which are further subdivided into a total of 68 chapters.

* **Part 1 (chapters 1-13)** covers the basic aspects of PET, SPECT and CT scanning as well as those of PET/CT and SPECT/CT. It provides a quick review of basic physics of radioactivity, radioactive decay and production of radionuclides as well as basic physics of PET and SPECT instrumentation, image production and image processing. There are some minor data inaccuracies in this part, e.g. the authors mention that ^{99}Mo decays only by emission of beta radiation, however ^{99}Mo also decays by gamma emission. Also, the authors mention that from ^{99}Mo-^{99m}Tc generator, the ^{99m}Tc is extracted from the alumina column as ^{99}Tc ion. It should actually be technetium pertechnetate ($^{99m}TcO_4^-$). Perhaps the authors could have expanded a bit more about the generator which is a source of 85% of our radiopharmaceuticals. The basic physics of PET and SPECT, is in generally well covered, clear and easy to be understood by the targeted clinicians and residents in-training. The

section on image co-registration and image rendering is great with good use of good illustrations. The chapters on quantification of PET and imaging are well developed, but would be more useful for researchers rather than clinicians.

- **Part 2 (chapters 14-20)** discusses the transition of PET and SPECT from research to clinical practice. The focus is on the various radiopharmaceuticals used in these investigations and also on clinical protocols. Although ^{18}F-FDG is the most commonly used radiopharmaceuticals for PET, the authors cover the use of this and a broader set of other radiopharmaceuticals currently in clinical use, as well as those with strong clinical potential including C-11-labeled radiopharmaceuticals. This section summarises some of the important considerations regarding these radiopharmaceuticals and their desirable properties. Part 2 ends with a comprehensive treatment of the latest standards and imaging protocols for PET, PET-CT, SPECT and SPECT-CT.
- **Part 3 (chapters 21-27)** covers the clinical application of PET and SPECT in brain diseases. This section covers benign and malignant tumours of the brain, epilepsy, dementia, extrapyramidoldisorders, cerebral infections as well as cerebrovascular disease. Using very good illustrations the authors begin by discussing normal brain findings in SPECT and PET. Then the focus is on brain tumours, specifically imaging of astrocytoma, oligodendroglioma and glioblastoma and also their metastases and radiation injury. Imaging of cerebral infection with PET using fluorodeoxyglucose (FDG) is well covered in this section, particularly since MRI and CT have difficulty in distinguishing between brain abscess and tumours, especially if the tumour is necrotic. An argument of how FDG-PET may be helpful in this area is made as well as the use of FDG-PET in distinguishing between toxoplasmosis and lymphoma in HIV patients. The chapter on cerebrovascular disease also includes an interesting section on methodologies for quantitative perfusion imaging. Chapter 20 is a good review of the existing types SPECT-CT hardware. It stresses the importance of quality control (QC). The tabulation of the protocols makes it easy for the reader to find what they need. The authors add a section on patient scheduling that may be useful for the organisation of a new department.
- **Part 4 (chapters 28-32)** covers the use of PET and SPECT investigations for the heart. The emphasis is on coronary artery disease and applications of PET and SPECT in the diagnosis. Of particularly interest in this section is the discussion of flow tracers in SPECT and PET and also metabolic tracers. Chapter 32 discusses integrated SPECT-CT in cardiac imaging and the use of attenuation correction.
- **Part 5 (chapters 33-57)** covers most aspects of body imaging in oncology including head and neck, thyroid, lung, pleura, gastrointestinal, colorectal and anal, breast, kidney, testicular, prostate and bone with very good illustrations. These chapters deal mainly with PET-CT and SPECT-CT imaging of tumours for staging and therapy monitoring and also radiation therapy planning. Regarding PET/CT, the focus is on^{18} F-FDG imaging of tumours which is currently the most important application of PET. This section also explains the use of the standardized uptake value (SUV) of lesions to differentiate benign from malignant tumours. Image artifacts due to technical and physiological problems are relevant to both molecular imaging and anatomical imaging techniques. The resulting artifacts in integrated images can be a problem in interpretation and need to be recognised. They are well covered and illustrated so this section would be helpful for any clinician who wishes to learn more about them. One chapter is reserved for PET and PET-CT applications in the planning of radiation therapy. PET/CT in radiation oncology planning is becoming more popular because it is capable of anatomic imaging and shows a wide variety of biochemical and biologic features of tumours that are known to influence radiation response and hence the potential of remission. The chapter is well organized and again well illustrated.
- **Part 6 (chapters 58-62)** is a short section that discusses imaging of inflammation in the body and the use of FDG-PET and SPECT-CT to detect infection and inflammation in various clinical settings. It includes musculoskeletal problems as well as infection in patients with prostheses and rheumatology disease.

* **Part 7 (Chapters 63-68)** is concerned with miscellaneous and non-standard applications of PET-CT and SPECT-CT. It includes benign disease conditions, notably thyroid and parathyroid as well as benign bone tumours. There is a short section on the use of SPECT-CT in the diagnosis of pulmonary thromboembolism. The book ends with a discussion of paediatric applications in a set of separate chapters because of the particularities of investigations in children using ionizing radiation.

Overall, this is a good textbook of clinical molecular imaging. It discusses well the clinically practical aspects of this modality. Its contents are well organised, each chapter starting with an informative abstract of contents. The references are mostly up-to-date, with suggestions for further reading.

Although the book is fairly comprehensive in molecular imaging with respect to PET and SPECT, some sections could be improved e.g. the cardiac section could be more comprehensive at least for the nuclear physicians working at cardiac centres. In addition, it would have been good to include a section on optical molecular imaging which is a rapidly evolving clinical imaging modality, as well as a few statements on the newer hybrid imaging tools such as optical-ultrasound mammography and optical-MRI tools. The book comes with a CD-ROM that contains over 80 full cases that can be studied separately, but which are also referenced in the book making the reading more interactive.

Residents, radiologists, nuclear physicians and practising clinicians who would like a quick reference on topics such as PET, SPECT and integrated PET-CT and SPECT-CT will find this book very useful. I recommend it highly to this group and to students interested in the subject. Also it is a good book for basic scientists and their students interested in medical imaging and its relevance.

REVIEWER

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