

## PET/MRI

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In recent years, new technologies allowing the integration of different imaging modalities have progressively been developed and several of them are now well established in routine clinical settings.

In the emerging field of new molecular imaging techniques, the combination of images derived from different imaging modalities is particularly prominent, with positron emission tomography/computed tomography (PET/CT) systems now widely used in clinical practice.

More recent advances in multimodal imaging are now leading to a new hybrid modality, in which PET is combined with magnetic resonance imaging (PET/MRI). The PET/MRI systems developed today offer different solutions for the acquisition of PET and MRI data in a single setting, allowing simultaneous or sequential data acquisition with perfect registration of morphological and biological data. PET/MRI systems offer some advantages over PET/CT, including a significant reduction of radiation dose to the patient, excellent soft tissue contrast, and optimal functional imaging capabilities. Furthermore, the combination of PET/MRI is expected to provide many advantages that go far beyond the mere integration of

functional PET with structural MRI information, and could, therefore, represent the new era in molecular imaging.

In view of these new perspectives, it seems particularly interesting to present an overview of the state-of-the-art of PET/MRI developments and potential applications, including the most important advances recently allowed by the use of this multimodal molecular imaging technique in both research and clinical settings.

This first issue of “Clinical and Translational Imaging Reviews in Nuclear Medicine and Molecular Imaging” is devoted to this new modality, which is currently one of the most innovative and debated topics in our discipline.

Leading experts in PET/MRI were asked to present different aspects of this emerging hybrid modality, and to discuss the new opportunities and potential applications it offers.

In particular, the issue includes an overview of the different hybrid PET/MRI scanners currently available. Many technical challenges and potential technical solutions are reviewed, including the simultaneous acquisition of multifunctional data, the possible interferences between the two scanners, the different techniques for PET attenuation correction, and various other technical innovations that allow combination of these two advanced imaging technologies without compromising their original performances.

The early results from clinical and research experiences of leading groups, among the first to adopt PET/MRI techniques, are presented. In particular, the current role and the potential opportunities offered by PET/MRI in oncology, cardiology and neurology imaging are addressed. Furthermore, its use in radiotherapy planning is presented and discussed, exploring the combination of PET and MRI as a promising tool in clinical practice.

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By identifying specific cellular and molecular targets, PET/MRI molecular imaging may play a crucial role in understanding biological processes in vivo, providing

accurate and early detection of specific targets, and thus, driving the development of innovative diagnostic and therapeutic strategies.