

KSMI-KSMRM Joint Symposium_Technology and applicatgion of PET/MRI

SY24-1

Simultaneous Multiparametric PET/MRIImager for Small-Animal Imaging

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Semiconductor photosensors are continuously evolving and eventually likely to replace the conventional photomultiplier tubes (PMTs) in clinical PET/CT and PET/MRI. PET detectors and systems based on silicon photomultiplier (SiPM), which is a semiconductor photosensor with sufficiently high internal gain, have already outperformed the PMT-based detectors and systems. For the last several years, we have focused on the development of a very compact SiPM PET system that is readily combined with small-animal dedicated MRI systems. In this talk, I will present the combined PET/MRI system and demonstrate the capabilities of this novel system on in various rodent imaging studies.

Keywords : PET, PET/MRI, Small animal

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SY24-2

Challenging technologies in MRI-PET integrated system

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Many different imaging modalities have been developed for clinical diagnosis, each of which has specific characteristics and advantages. However, one modality can not provide various requirements and solutions for accurate and fast diagnosis. One of solutions to overcome the limitations in each modality is to integrate or combine multiple modalities into just like one imaging system. There are many examples of integration of multiple modalities, such as PET-CT, MRI-EEG, MRI-PET, and so on.

In this talk, technologies for integration of MRI and PET are introduced. MRI has many advantages such as soft tissue contrasts, high spatial resolution, imaging of various physical parameters, no radioisotopes, no radiations, etc. PET has also strong advantage of high contrast metabolic information. Therefore, integration of two modalities provide a challenging opportunity for studying brain functions and cancer study. If two systems are combines, MRI can provide high spatial resolution and PET provide high contrast just like firefly at night. However, there are many challenges in technology for integration of MRI and PET. Core vehicle of MRI is the high and uniform magnetic field, and MR signal is measured as very tiny RF signal which can be easily contaminated by external RF noise. Conventional PET utilizes photomultiplier tube (PMT) to amplify the measured signal, which is very sensitive to magnetic field. In order to overcome these challenges, silicon-type photomultiplier that is not sensitive to the magnetic field had been introduced and several technologies have been developed to reduce RF noise in MRI. We developed head-only MRI-PET system and obtained in-vivo images.

In this talk, our experience of development of head-only MRI-PET integrated system is presented.

Keywords : MRI-PET, Multi modalities, Magnetic field, Integrated system

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SY24-3

Clinical application of PET/MR for Patients with Head & Neck Cancer

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Adequate evaluation of head & neck cancer is not an easy work. Although CT tends to give better resolution than MR, MR has several advantages including better soft-tissue contrast and reduced metallic artifacts than CT in addition to being free from radiation exposure. MR also can apply various advanced imaging techniques that can give diverse functional information. However, MR has still some limitation for evaluation of nodal involvement and small primary tumors. Meanwhile, 18F-FDG PET has a great difference from MR in the aspect that it gives metabolic information of tumor. It has also a great potential benefits to reveal small lymph node metastases and primary tumors together with the advantage of a whole-body staging within one examination. But the poor spatial resolution of PET is not suitable to evaluate the lesions within complex anatomy of the head and neck. Furthermore, the physiologic uptake of FDG in the head and neck may diminish the accuracy of PET. In this regard, although the benefits of PET/CT have been established in head and neck malignancies, the benefit of PET/MR needs to be more clarified. In this lecture, the issues of whether PET/MR is really beneficial compared to PET or MR alone, when and how it is beneficial will be presented by the representative clinical cases. Advantages and disadvantages of PET/MR in comparison with PET/CT will be also discussed.

Keywords : PET/MR, Head and neck cancer

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SY24-4

Clinical Experience and assignment of integrated whole body PET/MR in YUMC

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PET/MR scanner has been expected to play a key role in research and clinical applications because of superior tissue contrast and multi-parametric imaging of MR in conjunction with PET like PET/CT gained wide approval for oncologic, neurologic and cardiac imaging in recent years. PET/MR imaging shows the distribution of molecular tracers with picomolar sensitivity providing molecular imaging about cell metabolism and receptor status by PET and the excellent anatomical information with superb soft-tissue contrast and functional information on perfusion and diffusion by MRI. PET/MR has the potential to broaden our horizons in the emerging field of molecular imaging in the oncology, neurology and cardiology because complementary anatomic and biologic information is obtained and synergism of both modalities can be expected. But this novel imaging technology should prove the impact on diagnostic accuracy, the effect of therapy management and cost-efficiency. In our hospital, F-18 FDG PET/MR imaging is applied for staging of various cancers and pediatric patients. Also, I have clinical experience about cardiac PET/MR imaging. I will summarize the major advantages and disadvantages and workflow considerations for PET/MR imaging and present the clinical experience and assignment of integrated whole body PET/MR imaging.

Keywords : Integrated whole body PET/MR