Recognizing the Advantages of PET/MR

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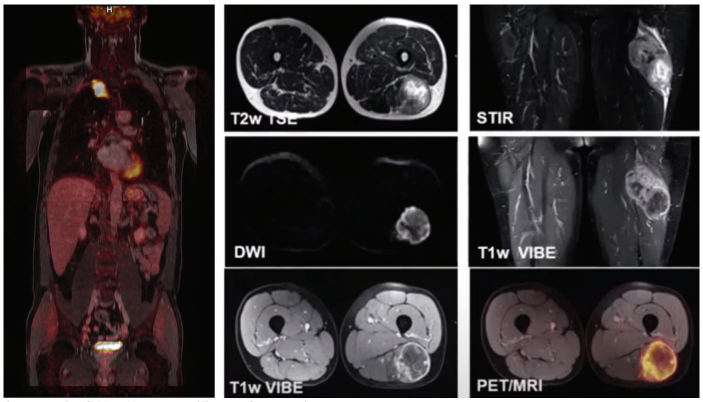
The first PET/MR scanner is expected to be installed at UCLA in late May or early June of 2021. There are only around 250 dedicate PET/MR systems operational worldwide, with around 50 located in the US (compared to over 2,000 sites using PET and PET/CT systems in the US). PET/MR is a hybrid imaging device that is still mostly limited to large academic centers.



Courtesy Prof. Ken Herrmann (Essen, Germany)

Whole-body coronal 18F-FDG PET/MR in a patient with NSCLC (left). Regional multiparametric MR sequences and fused 18F-FDG PET/MR in a patient with soft tissue sarcoma of the left upper leg (right).

Similar to PET/CT, PET/MR images mostly encompass the whole body from head to mid-thigh or foot. Unlike the sequential acquisition of a PET/CT scanner, MR and PET images are acquired simultaneously in the Siemens Biograph mMR.

Standard whole body MR sequences for anatomic correlation can be complemented with dedicated regional MR protocols benefiting from the improved MR soft tissue contrast, the information gathered from multiparametric MR sequences, or for example, the use of hepatobiliary contrast agents. Simultaneously, molecular PET information is acquired using radiotracers such as the pan-cancer tracer 18F-FDG for detection of increased glucose metabolism, 68Ga-DOTA-TOC for imaging of somatostatin receptor positive neuroendocrine tumors, or the newly FDA approved radiotracer 68Ga-PSMA-11, which has become a game changer for patients with prostate cancer.

According to a survey of 39 international sites, clinical PET/MR operation had a strong focus on oncology (88 percent), neurology (9 percent), and cardiology (3 percent).

Within oncologic applications, PET/MR can be used as a pan-cancer imaging device similar to PET/CT. However, the costs, workflow considerations and the strengths and limitations of PET/MR do not suggest using it as a replacement for PET/CT. Rather it should be used to specifically improve clinical care and diagnosis in selected patients, such as those with head and neck cancer, prostate cancer, and brain tumors.

Obvious strengths of PET/MR include the improved soft tissue contrast derived from MR images and the information gained from diffusion weighted and dynamic contrast enhanced imaging. Moreover, the improved convenience for patients scheduled for both imaging procedures creates value. Radiation dose, although a topic of controversy, is significantly lower using PET/MR in comparison to PET/CT. This has particularly been studied in pediatric cancer patients. This advantage is offset by the more frequent requirement of sedation for adult and pediatric PET/MR studies. Less obvious strengths of PET/MR are an improved PET count statistic since the PET acquisition can be prolonged for the time of the MR acquisition per bed position, and better motion correction in comparison to PET/CT.

PET/MR operations address clinical problems and research questions (47 percent and 45 percent, respectively). Potential research applications are limitless and explore topics as diverse as prognostic and predictive biomarkers derived from PET and multiparametric MR that have great potential to improve assessments of treatment response and outcome predictions.

PET/MRI operation is a team effort. Protocols are still in development and indications are evolving. The partnership between radiology and nuclear medicine at UCLA is an excellent starting point to establish PET/MR as a highly relevant imaging modality at UCLA. R

UCLA SMART Health Looking to Data and Technology for Transformative Change

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The UCLA Center for Systematic, Measurable, Actionable, Resilient, and Technology-driven (SMART) Health is a campus-wide collaborative that looks to the integrated transformation of health care through emergent data and technologies. Led by Alex Bui, PhD, the center brings together diverse UCLA experts to shape how digital and data-driven health care technologies will help to manage risk, reliability, resilience, uncertainty and precision in future biomedical research and clinical care.

The goals of the center are to enable team science around digital health care technologies, support interdisciplinary education and training, and catalyze partnerships with industry and NGOs. smarthealth.ucla.edu/