



PHYSICS

Developing quality assurance tests for simultaneous PET-MR imaging for radiotherapy planning

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What was your motivation for initiating this study?

Positron-emission tomography/magnetic resonance (PET-MR) imaging has great potential to improve radiotherapy treatments through a combination of high-quality MR anatomic, MR functional and PET molecular information with high spatial alignment. These can be used to drive dose painting radiotherapy strategies as well as treatment response monitoring. Images for radiotherapy planning must be robust and accurate, especially when used for dose painting. These require the performance of quality assurance (QA) tests that are designed for radiotherapy purposes. The aim of this study was to develop such QA tests and to evaluate their repeatability over three measurements in a single day and stability over six months.

What is the most important finding of your study?

We developed tests for electromechanical accuracy, MR image quality, large-field-of-view MR geometric distortion and the accuracies of PET-MR alignment, PET standard uptake values and diffusion-weighted MR apparent diffusion coefficients. Each of these tests was shown to be repeatable and stable over the investigated periods.

What are the implications of this research?

The development of QA tests for PET-MR for radiotherapy planning, when combined with clinically relevant tolerance levels, will enable the implementation of a QA programme. This in turn will facilitate clinical trials and clinical implementations of PET-MR for radiotherapy planning.



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