PET-CT Imaging with C11 Tracers

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Molecular imaging techniques are used to generate maps of functional and biochemical activity in target tissues in vivo. Currently, PET is one of the most successful techniques in the diagnostic work-up of tumours, its importance deriving from its ability to address various metabolic features of malignant carcinomas, relevant for diagnosis, classification, characterisation, preoperative evaluation, radiotherapy planning and post-therapeutic monitoring.

PET/CT is defined as an integrated or multimodality technique that employs a combination of a PET and a CT system with a single, conjoined patient handling system. It allows sequential acquisition of corresponding PET and CT portions of the examination with the patient in the same position for both PET and CT and enables co-registration of both data sets. It has grown in importance, especially thanks to the increasingly widespread availability of radiopharmaceuticals. PET/CT not only contributes to differential diagnosis, but also offers the possibility of tailoring imaging to different clinical indications. The two main metabolic features extensively studied so far are glucose metabolism by means of 18F-FDG and the amino acid transport (incorporation) using amino acid radiopharmaceuticals such as 11C-methionine (11C-MET) and 11C-choline (11C-CHOL) that will be the major topic of this talk. In the spirit of continuity with EANM and international guidelines on the topic, we shall cover the major clinical applications of these radiopharmaceutical, together with 11C production, tracer synthesis, acquisition methods and patient preparation; some notes are also provided on quantitative imaging, radiotherapy planning and daily practice with fast decaying tracers. Oncological imaging is a competitive diagnostic environment, in which 18F-FDG still play the major role, but many tools are technically evolving to offer the best solutions available for patient care. Nuclear Medicine accepts the challenge and this talk, is designed to identify clinical scenarios in which PET-CT beyond 18F-FDG may impact patient clinical management and differential diagnosis become a daily practice activity.

Suggested readings:

1 Varrone A, Asenbaum S, Vander Borght T, Booij J, Nobili F, Nagren K, et al. EANM procedure guidelines for PET brain imaging using [18F]FDG, version 2. Eur J Nucl Med Mol Imaging. 2009;36:2103–10.

2 Fragoso Costa P, Santos A, Vidovic B. Brain Imaging: A technologists's guide, European Association of Nuclear Medicine. 2015

3 Van den Broek WJM, Testanera G. Principles and practice of PET/CT. Part 2: A technologist's guide. European Association of Nuclear Medicine. 2010.

4 Vander Borght T, Asenbaum S, Bartenstein P, Halldin C, Kapucu Ö, Van Laere K, et al. EANM procedure guidelines for brain tumour imaging using labelled amino acid analogues. Eur J Nucl Med Mol Imaging. 2006;33:1374–80.

5 Gregoire V, Chiti A. PET in radiotherapy planning: Particularly exquisite test or pending and experimental tool? Radiother Oncol. 2010;96:275–6.

6 International Atomic Energy Agency. A guide to clinical PET in oncology: Improving clinical management of cancer patients. International Atomic Energy Agency. 2008