HealthManagement
Promoting Management and Leadership

Volume - 5 - Issue 1, 2006 - Cover Story

Nuclear Medicine

Author

Rodrigo Moreno-Reyes, *MD PHD*

Department of Nuclear Medicine Department

Erasme Hospital

Brussels, Belgium

The clinical impact of nuclear medicine has increased dramatically since the use of Positron Emission Tomography (PET) scans became routine.

It is the management and treatment of cancer patients which has benefited most from clinical PET. The strength of PET used in oncology lies in its ability to provide information which cannot be obtained by other imaging techniques such as computed tomography (CT) or magnetic resonance imaging (MRI). PET is not only capable of assessing the probability of tumour malignancy, but can also provide information for staging and monitoring therapy response

PET scanning produces images of metabolic activity, receptor status and blood flow information. The most widely use radiotracer in clinical PET is the glucose analogue 18F-fluorodeoxyglucose (18FDG). Because malignant tumours are characterized by increased glycolysis and the amplification of glucose transporter proteins to compensate for their inefficient glucose metabolism, 18FDG is a good marker of malignant cells. One characteristic of radiotracers used in PET scanning is their short half-life. Even if the 110 minute half-life of 18FDG is sufficient for adequate distribution, this is not the case for other isotopes such as C-methionine. This radiotracer of neutral amino-acid uptake and protein synthesis is very useful in the diagnosis, follow-up and PET-guided radiosurgery of brain tumours. However, because of its short half-life (20 minutes), only centres with cyclotron facilities can produce and perform PET imagining with 11Cmethionine. The commercial development of

an 18F- amino-acid derivative will almost certainly solve this problem in the near future.

Regional staging of cancer patients using conventional techniques such as CT, is based on the arbitrary categorisation of lymph node dimensions. Lymph node magnitudes equal to 1 centimetre or less are considered normal. In contrast, PET imaging does not depend directly on tumour size but rather on the metabolic activity of the neoplasic cells. Therefore a one- centimetre or smaller malignant lymph node will be missed by CT but may be detected using PET.

Another strength of PET is its ability to differentiate between residual malignant disease and fibrosis. This is particularly important after a tumour has been treated by radiotherapy which may induce a fibrotic response. The question of whether the abnormalities seen following radiotherapy are malignant, or secondary to fibrosis may be better answered using PET rather than with CT.

The recent introduction of PET-CT scanners has further increased the accuracy of PET imaging in oncology. This new modality permits the simultaneous co-registration of metabolic and anatomic images. PET-CT has been found to improve the diagnostic accuracy of staging non-small-cell lung cancer when compared to PET or CT alone. The increased diagnostic accuracy of PET-CT may also apply to other cancers such as lung, as well as to infectious diseases and bone disorders.

Virtual coronarography using PET-CT imaging is a very promising application for clinical PET. Because it provides information simultaneously on coronary artery anatomy and metabolic activity, its introduction will probably spare many patients unnecessary coronarography.

Bone and joint disorders are currently diagnosed and monitored using bone scans with technetium-labelled MDP. Bone scans have a high sensitivity for detecting bone and joint abnormalities. However, specificity and spatial resolution are poor. In contrast, the enhanced spatial resolution and quantification offered by PET is likely to increase diagnostic accuracy, particularly where PET imaging employs the bone tracer 18F-fluoride.

Clinical PET is a rapidly developing field of Nuclear Medicine. New technical and radiotracer developments are likely to further improve its diagnostic accuracy. So far the main constraint on the widespread use of PET is financial. Applications, other than oncology, will gradually become routine, as equipment costs continue to fall.

Published on : Sun, 12 Feb 2006