

National PET Centre

The most important project of the further development of domestic nuclear medicine is introduction of positron emission tomography (PET) into the public health care system of Serbia. Its base includes construction and equipping of the National PET Centre, as a part of the Institute of Nuclear Medicine of Clinical Centre of Serbia (CCS).

Namely, PET belongs to the nuclear medicine field and it represents the unique technique enabling imaging and *in vivo* “measurement” of physiological and biochemical processes at the cellular and molecular levels. The former is achieved by application of biologically active substances comprising radioactive isotopes – positron emitters, out of which ^{18}F , ^{11}C , ^{13}N i ^{15}O are the most commonly used. Namely, the above-mentioned radiolabelled substances, the so-called radiopharmaceuticals maintain their properties after introduction into the patient’s organism and participate in the specific cellular processes. Owing to the fact that characteristics of these processes are different between the diseased and healthy tissues and organs, external recording of radiation from the selected zones or from the whole body using the special device (PET scanner), will enable visualization of the localization and spreading of the studied diseases and disorders. The possibility of additional quantitative assessment of the acquired data through application of different modalities of the computer processing significantly enhances diagnostic potentials of the PET technique. More than 120 positron radiopharmaceuticals are currently available and used in clinical and research purposes.

Since the half-life of the most commonly used positron emitters, except for ^{18}F , is usually only minutes long, they must be produced at the site – in the health care institution itself. Therefore, contemporary centres for comprehensive PET diagnostics are equipped in addition to the units intended for patients’ imaging, with special machines for production of positron emitters (medical cyclotron) and synthesis of different radiopharmaceuticals (automated radiochemistry laboratory). It should be mentioned that hybrid PET/CT devices are increasingly frequently used instead of classical PET scanners, essentially with an aim to simultaneously localize more precisely functional changes visualized by PET, by analyzing the obtained fusion images. Hybrid PET/MRI and SPECT/PET/CT devices are also under development.

Owing to its exceptional potentials, PET has a major role in modern diagnostics of the most severe and most frequent (oncological, neurological and cardiological) diseases, and thus contemporary tertiary health care institutions cannot maintain their rank if they are not equipped with PET technique.

PET is most widely applied in the field of oncology. Owing to the fact that metabolic processes in the tumor tissue are accelerated and enhanced, application of the appropriate radiopharmaceuticals will give clear image of the viable tumor tissue. Therefore, the technique is highly sensitive for detection of both regional and distant metastases and differentiation between recurrent and rest viable tumors from the fibrosis caused by surgical and radiation treatment. Moreover, PET is used for assessment of the malignant potential of the tumor, prognosis of the disease as well as tumor sensitivity to specific chemotherapeutic agents. It also enables precise planning of radiation therapy. For this reason, PET introduction in routine oncological diagnostics is of the utmost importance. Owing to the development of a range of specific radiopharmaceuticals, it is currently also possible to visualize using PET different aspect of brain function, and thus, the technique is increasingly widely applied in neurology, considerably contributing to diagnosis of different types of dementia, early diagnosis of parkinsonism as well as to precise determining of localization of epileptic foci for the purpose of their surgical removal. As for the cardiological diagnostics, PET enables precise assessment of vitality of the heart muscle in patients with coronary disease, significantly contributing to decision-making on application of the contemporary methods of interventional cardiology, coronary blood vessel bypass surgeries and heart transplantation.

Owing to rapid and accurate establishment of diagnosis, PET enables timely and appropriate treatment and thus better prognosis of the disease and the patients are at the same time spared of long, frequently invasive diagnostic and therapeutic procedures. All the above-mentioned together contributes to significant saving of the health care budget.

The concept adopted by the Expert group with the Ministry of Health envisages realization of the National PET Centre in two phases. Realization of the phase I is in progress, i.e., construction of the clinical department of the Centre that will be located in the basement of the current CCS Polyclinic building is underway, to be put into operation in the first part of 2009. The Centre will be equipped, based on the international standards, first with one and thereafter with the another hybrid PET/CT device. Initially, PET procedures exclusively based on radiopharmaceutical ^{18}F -deoxyglucose (FDG) shall be applied, and the radiopharmaceutical will be temporarily imported through the specialized distributor. After completion of the phase II of the project planned for mid 2010, which includes construction and equipping of the manufacturing department of the Centre (medical cyclotron, radiochemistry laboratory) National PET Centre will also provide PET methods based on radiopharmaceuticals labeled with positron emitters ^{11}C and ^{13}N , which must be produced at the site due to their short half-life. Owing to the technical cooperation project with IAEA, three physicians employed at the Institute were trained for application of PET methods during 2007. This specialized UN Agency has approved our application and significant funds will be allocated for the new project that will enable, among others, financing of appropriate training the necessary staff for work in clinical and manufacturing departments of the Centre.

National PET Centre will also supply „satellite“ PET centres that will be established within the selected tertiary health institutions with FDG (Institute for Oncology in Sremska Kamenica, Clinical Centre of Niš, Clinical Centre of Kragujevac), taking into account the fact that one PET (PET/CT) device using, based on the current standards, should cover the population of one million. Owing to the established concept, all conditions are present for the Center to be granted the status of the “pilot” health care, scientific research and developmental institution for the whole region.

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