New radiopharmaceuticals labeled with ^{18}F: ^{18}F-FLT and ^{8}F-choline

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Introduction

The use of radiopharmaceuticals for molecular imaging of biochemical and physiological processes in vivo has evolved into an important diagnostic tool in modern nuclear medicine and medical research. Positron emission tomography (PET) is currently the most sophisticated molecular imaging methodology, mainly due to the unrivaled high sensitivity which allows for the studying of biochemistry in vivo on the molecular level. This stimulates the proposition of research and development of new radiopharmaceuticals and labeled molecules

The ^{18}F labeled glucose, known as [18F] fluorodeoxyglucose – FDG, is currently the most widely used PET radiopharmaceutical. However, it is important to point out that FDG is not the specific[1] radiotracer for imaging several malignant diseases. Also, some FDG application does not reflect a good metabolism in cancerous tissues. From the clinical perspective, the diagnoses of these diseases should consider more suitable characterization of the cancerous cells. This fact highlights the need for complementary use of other radiopharmaceuticals and other characterization techniques. This research proposal will include some new complementary techniques to the FDG PET.

From to recent statistical data, cancer is currently responsible for about 15% of total rate mortality. Also, according to INCA, the predominant types of cancer in the coming years will be the prostate, lung, breast and cervix.

This way, and following the global trends, we are applying projects to develop new labeled PET radiopharmaceuticals, as well as the nationalization of the production of [18F]-FLT (fluoro-thymidine). In this specific topic, the main reason is the greater specificity for monitoring the proliferation of tumor cells. In the case of diagnosis for the recurrence and metastasis of prostate cancer, the most suitable radiopharmaceutical is [18F]-Choline [2]. The greater specificity, for these types of cancer, will also contribute to the development of new therapies.

As a spin-off we can mention the consolidation of this technology, in routine care, and increasing of domestic content of techniques already in use.

Methodology of ^{18}F-FLT and ^{18}F-choline production

The production of new radiopharmaceuticals labeled with ^{18}F, as ^{18}F-FLT (fluoro-thymidine), and 18F-Choline will be obtained by the technique of bombarding liquids targets (H218O) with protons. The irradiations will be performed at the IEN's Cyclotrons (CV-28 and/or RDS-Eclipse). The irradiation will be followed by specific organic synthesis. The chemical processes will be carried out in automated synthesizers and special hot cells. All steps will be done by properly shielding ionizing radiation, as well as other manipulative elements in this research. After synthesis, the final product will be subjected to quality control, chemical, biological and radiochemical analysis.

References:

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