

Free nuclear medicine essay example

[Technology](#), [Development](#)



Positron Emission Tomography (PET), in recent years, has experienced accelerated development and has become an established method for medical research and clinical routine diagnostics. The development and availability of radiopharmaceuticals specific for particular diseases is one of the major driving forces for the expansion of PET (Fani et al, 2008, pg. 1). Currently, DOTA peptides such as DOTATOC, DOTATATE and DOTA-NOC among others are being promoted for routine clinical use in nuclear medicine. The increase in the knowledge of purification and the concentration of the eluate and the complex ligand chemistry has led to the (68) Ga-labeled pharmaceuticals with a major impact. Today, Ga-labeled pharmaceuticals have the potential to cover all clinical options. The (68) Ga-labeled analogs of octreotide including DOTATOC, DOTANOC and DOTA-TATE are mostly used in nuclear medicine. These analogs are most frequently applied in all of the (68) Ga-labeled pharmaceuticals. Nuclear medicine is a rapidly expanding field for the diagnostics and therapy on both cellular and molecular level (Fani et al. 2012). Many radiolabeled peptides that bind with high affinity and specificity to the receptors on tumor cells, are constantly being used for diagnostic imaging and targeted radionuclide therapy for tumors in bodies.

Peptides can be labeled with different radionuclides for imaging and targeted radio-nuclide therapy applications (Chinol & Paganelli 2006, pg. 1).

Conjugation and purification of the peptides are usually the processes that precede the labeling of these peptides. Radiolabeled peptides such as the DOTA peptides are mostly used for diagnostic and therapy purposes. ^{111}In is the most widely used radionuclide for imaging and diagnostic purposes. The

labeling of DOTA peptides designed for either diagnostic imaging or radionuclide therapy involves the use of radio metals. This always requires the radio metal to be stably attached to the peptide using a bifunctional chelating agent. Many radionuclides have been used for the labeling of DOTA peptides for either diagnostic or therapy clinical applications. Gallium- 68 (^{68}Ga), Copper - 64 (^{64}Cu), Indium - 111 (^{111}In) are some of the radionuclides that are used in the labeling of DOTA peptides for diagnosis. Lutetium - 177 (^{177}Lu), Yttrium - 90 (^{90}Y) and Bismuth - 213 (^{213}Bi) are used in the labeling of DOTA peptides for therapy. The (^{68}Ga) has attracted interest as a radionuclide for PET as a result of its suitable 68min half-life, high positron emission yield and the availability from (^{68}Ga) generators (Fani et al 2012, pg. 9). All these properties make it independent of cyclotron production. The (^{68}Ga) labeled DOTA peptides have driven the development of technologies that provide these radiopharmaceuticals for clinical applications including diagnosis and therapy.

The DOTA peptides are mainly used routinely for diagnosis imaging and radionuclide therapy. A major advantage of (^{68}Ga) generator is its continuous source of (^{68}Ga) independent from an on-site cyclotron. There has been limited therapeutic success in recent times due to the insufficient chemotherapeutic drugs that lack the ability to target specifically tumor tissues. Recent DOTA peptides have been developed to enable the concurrent imaging and therapy of tumors expressing a specific target. The use of modern imaging methods including PET provide information about phenotypic functional changes associated with the development of the diseases. PET is a non-invasive nuclear medicine technique that allows the

evaluation of metabolic processes and the disturbance of these processes by disease. PET with radiolabeled regulatory peptides has been shown to be a sensitive and specific technique to demonstrate the presence of receptors in tumors (Mazen et al. 2013, pg. 4). New treatment modalities have been developed based on the biological properties of tissues, and this progress has been achieved using these peptides. DOTA peptides also offer a pathway to personalized diagnosis and treatment to these diseases as compared to other methods currently being used for treatment and diagnosis (Baush & Rosch 2013, pg. 3). The use of these radiopharmaceuticals, for imaging organ function and disease state a unique capability of nuclear medicine. Unlike the other imaging procedures including Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) among others, the use of these radiopharmaceuticals is capable of mapping physiological function and the metabolic activity. By doing so, they give more specific information about organ function and dysfunction.

The use of DOTA peptides has proven to be cost-effective and cost-saving. PET has demonstrated to be cheaper as compared to cyclotron which is quite expensive in the production of generator produced ^{68}Ga radionuclide. The further technological development might render cost reduction and might even consequently improve profitability and affordability (Okarvi 2004, pg. 357) . This in turn may stimulate the further investments in radiopharmaceutical research and development. The insistence on higher sensitivity, higher resolution and dynamic scanning make the use of DOTA peptides to be cheaper and effective as compared to the other radiopharmaceuticals. The introduction of PET tracers labeled with $(^{68})\text{Ga}$

has changed the diagnostic approaches to tumors. The accuracy of DOTA peptides in the detection of tumors as compared to the morphological imaging procedures, offers the potential for further research and innovation that would lead to the effective treatment of tumor-related diseases.

Works cited

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