Targeted therapy with radiopharmaceuticals is an emerging modality for the treatment of many cancer patients either alone or in conjunction with other modalities like surgery and chemotherapy due the possibility of delivering doses selectively to the tumor and treating widespread multiple metastases.

The development of new radiopharmaceuticals for cancer therapy based on different molecules which may be labelled with beta-gamma emitters is an outstanding field of research, having application in the therapy of a wide variety of tumors like those of neuroendocrine origin, lymphoma, breast cancer, melanoma, and bone metastasis derived from primary tumors.

In particular, the research with new radionuclides like Lu-177 is advancing due their promising physical and chemical properties like its half life of 6.7 days, relatively low $\beta$- energy (149 and 497 keV) rendering a range of tissue penetration from 0.5 to 2 mm and $\gamma$ emission (113 and 208 keV). These properties allow to obtain scintigraphy images of the biodistribution, to perform dosimetric calculations and to produce the desired therapeutic effect specific to its $\beta$- emission in small sized tumors or metastasis.

The other key factor are the carrier molecules that have a specific bind to cancer cells through specific interaction with different cellular components, such as receptors, surface antigens or physiological uptake.

Our objective was to search molecules directed to those targets, and design the strategy for its labeling, radiochemical purity analysis, stability evaluation, biological behavior studies that involves from in-vitro bioactivity studies, metabolism and processing cellular analysis, determination of the route and rate of excretion, studies of the biodistribution using in vivo and ex vivo techniques, imaging in animal models, dosimetry studies to fully characterize the radiopharmaceuticals in order to apply in patients.

Among them we have research the following molecules: Somatostatin analogs for treatment of neuroendocrine tumors (DOTA-TATE), KCCYSL for melanoma, monoclonal antibody anti-hR3 for EGFr expressing tumors, monoclonal antibody anti-CD20 for treatment of Non Hodking Lymphoma, humanized anti-human VEGF-A monoclonal antibody (Bevacizumab) for angiogenesis control, EDTMP as bone pain palliating agent, dendrimers as carriers of radionuclides to tumors.

In the case of antibodies and dendrimers the first step is the conjugation of DOTA to the molecule and the purification of product.
The labeling conditions were optimized in each case controlling the radiochemical purity by chromatographic methods (i.e. HPLC-RP, gel permeation, ITLC) and physicochemical parameters. Stability was studied in vitro and in vivo. Receptor and cell studies were done for DOTA-TATE and antiCD-20 antibodies. Biodistributions were done in normal mice and in tumor induced models (C57 black mice previously inoculated with B16F1 cells and spontaneous adenocarcinoma). From these data dosimetry evaluation was accomplished using Monte Carlo Simulation method, Subroutine Penelope.

The radiochemical purity of the radiopharmaceuticals labeled in optimized conditions was higher than 95% in all cases, but for antibodies a purification step was required. Receptor and cell binding studies were very valuable to assure the specific binding of DOTA-TATE and anti-CD20. ^{177}\text{Lu-EDTMP} and ^{177}\text{Lu-DOTA-TATE} are in the early stages of clinical evaluation in patients through the development of a cold kit formulation and a harmonized clinical protocol in the case of EDTMP and the realization of the first therapeutic dose in a patient with a neuroendocrine pancreatic metastatic tumor in the case of ^{177}\text{Lu-DOTA-TATE} with promising results.

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