PhD position, Lyon, France
Absorbed dose quantification estimation for promising targeted radionuclide therapy cancer treatment

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The CREATIS laboratory and the Léon Bérard cancer centre (CLB, Lyon, France) open a PhD position in collaboration with OncoTherapy Science (OTS, Tokyo, Japan & Lyon, France). The Phd will be funded within a CIFRE agreement.

Context.
Targeted radionuclide therapy shows great promise for cancer treatment. In particular, the radiolabeled OTSA101 monoclonal anti-body (mAb), targeting FZD10 and developed by the OTS company, is a promising approach for synovial sarcoma and potentially other sites such as lung or colorectal cancers. This first-in-man clinical trial, called Synfrizz, is performed in two steps. In the first (planning) phase, the mAb is labelled with a low activity of ^{111}Indium and administrated to the patient. Clinicians analyse the biodistribution from SPECT-CT images and decide to treat or not the patient according to the uptake specificity. The second (therapeutic) phase is the administration of a high activity of ^{90}Yttrium labelled mAb that lead to the irradiation of tumor cells.

However, the effective absorbed dose distribution is still largely unknown and thus prevents efficient patient-specific treatments. During the Synfrizz clinical trial (2012-2015), large uptake heterogeneities have been observed between patients. Moreover, potential toxicity has also been observed. Thus, an accurate and patient-specific estimation of the absorbed dose by organs is crucial.

Currently, repeated SPECT-CT acquisitions prior to the treatment, generally with ^{111}Indium-mAb, are the only known approach to estimate this activity distribution. However, SPECT absolute quantification is limited by relatively poor special resolution, non-uniform attenuation, partial volume effect, patient motion and scatter contribution. Images should thus be corrected. Accuracy was previously estimated between 20-40% but evaluation validation on real clinical situations is rare.

Goal.
The goal is to propose a method to evaluate the 3D absorbed dose distribution within patients by retrospectively analysing SPECT-CT images. The precision and accuracy of the method will have to be validated. Then, dose distribution will be correlated with observed anti-tumor effect and toxicity. The method will have to be adapted for small-animals experiments with other radioisotopes.

Profile.
- The candidate must hold a master in image processing or medical physics.
- Scientific interests: computer sciences (medical image processing), x-ray and particle physics, Monte Carlo simulations.
- Programming skills: C++.
- Languages: French, English required.
- Location: Centre Léon Bérard, Lyon, France.
- Salary (gross): about 1900 euros/month.
- Period: 3 years starting early 2015.

Contacts.
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