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Report on status of posting results in the study registry(s) for WP2

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1. Introduction

The radiopharmaceutical dosimetry study performed under subtask 2.3.2.2 of the MEDIRAD project, to which this report is related was unfortunately delayed as indicated in the deliverable D2.11 (Midterm recruitment report for radiopharmaceutical dosimetry study; submitted to the European Commission and approved in January 2021).

A contingency plan for this study was discussed previously, and is currently underway.

2. Patient recruitment

Chronological summary:

- Nov 2019: Ethics approval was obtained for ^{18}F-FDG PET/CT and ^{99m}Tc bone SPECT/CT. The later protocols included 4 extra PET/CT or SPECT/CT acquisitions, and were summarized in D2.5.
- Then in 2020, most of the year was impacted by COVID epidemics, either because of locked down of the population and the cancellation of all non-urgent medical practice in hospitals (including stop of clinical trials).
- Even after that extremely difficult situation, the recruitment of patients remained difficult as the priority was given to postponed examinations and interventions.
- According to local regulations, the ethical authorisation had to be renewed, and this was obtained in June 2021.

The current situation is that the recruitment is open in Ghent, but no patient was enrolled to date (Oct 2021). The various reasons were already mentioned: in addition to the fact that this study has no direct benefit for the patient, the concern related to irradiation, even at a very low level, is deterring patients from enrolling for the trial. The point is that, for quantitative imaging and patient-specific dosimetry, the added value of (low dose) CT acquisitions is adding a (minor) contribution to the overall patient irradiation (radiopharmaceutical + “normal” CT). The COVID epidemics increases the reluctance of patients to stay in hospitals for longer than strictly necessary. The fact that the epidemics situation is not stabilised, with successions of increase and decrease of infections and hospitalisations certainty doesn’t help.

Currently 2 patients have expressed their willingness to participate to the SPECT/CT trial (Nov 4th and Nov 25th 2021), but this remains to be confirmed. Yet, even with the good news that recruitment may at last start, it is clear that the total number of patients expected will not be reached and alternate possibilities were investigated. In that context, we investigated alternative plans involving the use of already acquired data.

3. Alternative plan 1

The first plan considered using data from Ghent University Hospital, already collected for other purposes, and to perform a dosimetry study based on this data. The selected applications were that of a ^{99m}Tc-labelled tracer for infection (^{99m}Tc-labelled S-HYNIC certolizumab pegol) to document SPECT/CT acquisitions, and that of a ^{18}F-labelled tracer for prostate cancer (^{18}F-PSMA-11) to document PET/CT. This required a specific approval from ethics committees.

- Regarding ^{18}F PET/CT data, the approval is still pending.
- Regarding ^{99m}Tc data it appeared that acquisitions were in fact planar scintigraphies (sequential whole-body) and that decreased the scientific value of subsequent analysis (based on OpenDose3D [1], software for 3D SPECT/CT dosimetry specifically developed within MEDIRAD by partner INSERM).

It was therefore decided to investigate other possibilities to carry out WP2 subtask 2.3.2.2.

4. Alternative plan 2

4.1 PET/CT data

For PET/CT data, we decided to reprocess data used within the context of a past study performed at CRCT [2]. That study considered healthy volunteers administered a 18F-labeled brain tracer. The work considered the comparison of 3 different approaches, namely OLINDA V1 [3], by then the reference for model-based dosimetry, STRATOS [4], a research tool (now discontinued) proposed as an option of the Imalytics workstation of Philips, and a direct Monte Carlo modelling based on GEANT4 [5].

For MEDIRAD WP2 subtask 2.3.2.2, data from four patients (3 male and one female) could be extracted and reprocessed, using OpenDose3D (local energy deposition, convolution and direct Monte Carlo modelling based on GATE [6]) and compared with IDAC-Dose 2.1 [7] (updated model-based code for reference dosimetry according ICRP 103 [8]). Results will be presented in D2.17.

4.2 SPECT/CT data

For SPECT/CT data, we decided to use data extracted from the clinical study performed in WP3. This included a subset of 13 patients from RMH hospital, presented in D3.11. These patients benefited from a therapeutic application of 131I, however, the computation of absorbed doses delivered at a distance from the thyroid remnants falls in the category of “low doses“ and can be suited to WP2 subtask 2.3.2.2, i.e. to compare model-based vs. patient-specific dosimetry in a context of diagnostic.

Obviously, the change in isotope may have an impact on the results (in terms of delivered irradiation, as the yield and energies of the emitted photons differ between 99mTc and 131I). That aspect will have to be addressed and discussed in the dosimetric report. However, at this stage, this does not put in question the relevance of the comparison of model-based vs. patient-specific dosimetry, main objective of this task.

Data is being processed thanks to OpenDose3D, specifically developed within the MEDIRAD project, and adapted to 131I dosimetry. A comparison with results obtained with IDAC-Dose 2.1 is underway and will be presented in D2.17.

5. Conclusions

Despite the difficulties encountered in the recruitment that prevented performing the study as originally intended, we managed to get access to datasets adapted to the purpose of SPECT/CT and PET/CT dosimetry, and will complete WP2 subtask 2.3.2.2.

6. References

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