60 Comparison of organ-based absorbed doses estimations by using PLANET®Dose and OLINDA/EXM V2.0 in patients with peptide receptor radionuclide therapy (PRRT) treated with Lutathera®

E. Mora-Ramirez [a,b,c], E. Cassol [a,d,e], L. Santoro [f], S. Chouaf [f], D. Trauchessec [f], J. Pouget [g], P. Kotzki [f,g], E. Deshayes [f,g], M. Bardiès [a,b]

[a] *Cancer Research Centre of Toulouse, Toulouse, France*
[b] *INSERM, UMR 1037, University of Toulouse III Paul Sabatier, Toulouse, France*
[c] *University of Costa Rica, Physics School, CICANUM, San Jose, Costa Rica*
[d] *Nuclear Medicine Departments, Toulouse Hospitals, Toulouse, France*
[e] *Faculty of Medicine, University of Toulouse III Paul Sabatier, Toulouse, France*
[f] *Nuclear Medicine Department, Regional Institute of Cancer Montpellier, Montpellier, France*
[g] *Cancer Research Institute of Montpellier, UMR 1194, Montpellier, France*

Introduction. Lutathera® [1] have been used to treat patients with neuroendocrine tumors. At the Cancer Research Institute of Montpellier the first patients were treated during 2016. Two software available on the market can be used to compare organ-based absorbed doses, the new version of OLINDA/EXM(OLINDA) V2 [2] within HERMES workstation and PLANET®Dose (PDose) from DOSISOFT. The goal of this work is to compare organ-based absorbed dose estimations by using the local energy deposit approach (LEDA).

Methods. One female who benefited from Lutathera® was injected with a total activity of 7176.6 MBq [^{177}Lu-[DOTA0,Tyr3]-octreotate. Four SPECT/CT's were performed using the GE-Discovery NM/CT 670 at 4 h, 24 h, 72 h and 168 h. Dosmetric comparison was for liver, spleen, left and right kidneys. Segmentation and registration were carried on using PDose. Segmentation using the first CT image has been done organ by organ. Rigid registration was performed for each organ using two SPECT/CT's series and taking the first SPECT/CT as reference. The volume of reference was the same at all time for this dosimetric study and it was used to estimate the mass. PDose provides a bio-kinetics' analysis tools in which SPECT/CT calibration factors can be entered; bi-exponential fitting was chosen to estimate cumulated activities. Residence times were computed and entered into OLINDA in order to calculate beta-absorbed dose. On the other hand, PDose can establish the absorbed dose by LEDA choosing a bi-exponential fitting function and correcting for tissue density. To allow comparison with OLINDA, the absorbed dose to kidneys was performed weighting the left/right results by the mass.

Results. Liver, spleen, left and right kidney mass were 1636 g, 99 g, 145 g and 126 g, respectively. Residence times for liver, spleen, left and right kidney were 42.70 h, 0.62 h, 0.78 h, 0.82 h. For liver, spleen and kidneys absorbed dose estimations are 16.0 Gy, 3.9 Gy, 3.7 Gy for PDose and 16.8 Gy, 3.6 Gy, 3.5 Gy for OLINDA, respectively. Relative difference is −4.8%, 8.9% and 5.2% for the same organs. Using OLINDA other organs such as adrenals glands, lungs and pancreas also register absorbed doses.

Conclusions. Results obtained with PDose using the LEDA hypothesis (with density correction), weighting by the mass, are consistent with OLINDA (with mass correction) in ±10% for a selected group of organs. This preliminary study should be continued on other organs/tissues of interest in radionuclide therapy.

References

1. Novartis Media Relations. Advanced Accelerator Applications Receives FDA Approval for Lutathera® for Treatment of Gastroenteropancreatic Neuroendocrine Tumors. 1–9 (2018). Available at: https://www.novartis.com/news/media-releases. (Accessed: 6th April 2018)
2. Stabin, M. & Farmer, A. OLINDA/EXM 2.0: The new generation dosimetry modeling code. *J. Nucl. Med.* 53, 585 (2012).

https://doi.org/10.1016/j.ejmp.2018.09.073

61 Evaluation and comparison of a new low energy high resolution collimator

G. Le Rouzic, E. Biggs, M. Charpentier

Nuclear Medicine Service CHRO, Orléans, France

Introduction. In order to find an optimum compromise between spatial resolution and sensitivity, GEHC designed a new collimator (LEHRS) and combined it to a new acquisition software for planar images (Clarity2D) and to a new tomographic acquisition method: "step and shoot continuous". The objective of the study is to evaluate planar and tomographic performances of this new collimator and to compare them to GEHC LEHR and to Siemens LEHR.

Methods. In planar mode, sensitivity and spatial resolution were measured for the three collimators according to NEMA NU1–2000 [1]. In tomographic mode, volumetric sensitivity and spatial resolution were also evaluated according to NEMA NU1–2000. Image quality was measured according NEMA NU2-2012 (contrast of 8) [2]. Projections were acquired according to routine protocols and the volumes were reconstructed thanks to and independent software taking into account spatial resolution depth dependence and attenuation correction.

Results. Planar mode. Maximum sensitivity was measured for Siemens LEHR (100 cps/MBq), LEHRS's was 9% lower and GEHC LEHR's was 22% lower. The full width at half maximum of the linear spread function, at source contact, is equivalent for both LEHR and 5% higher for LEHRS. Nevertheless thanks to Clarity2D, LSF's FWHM degradation is less important when collimator distance increases. With 15 cm of diffusing material, LEHRS spatial resolution is 9,2 mm, GEHC LEHR is 10,1 mm and Siemens LEHR is 10,6 mm.

Tomographic mode. LEHRS volumetric sensitivity is superior to both LEHR's (16% for Siemens LEHR and 25% for GEHC LEHR). Spatial resolution is equivalent for the 3 collimators. The biggest hot sphere contrast recovery is equivalent for both GEHC collimators (41% for LEHR and 39,3% for LEHRS) and superior to Siemens LEHR (35,7%). LEHRS provides a better background variability (7,9%) than both LEHR (10,1% for GEC and 9,8% for Siemens).

Conclusions. In planar mode, LEHRS collimator associated to clarity 2D provides higher quality images than the other collimators since then enough diffusing material is placed between the source and the camera. In tomographic mode, the increase of volumetric sensitivity allows to reduce noise in the images (low background variability) while maintaining equivalent or superior contrast recovery and spatial resolution.

References

1. NEMA Standards Publication NU 1-2000 Performance measurements of scintillation cameras.
2. NEMA Standards Publication NU 2-2012 Performance measurements of positron emission tomographs.

https://doi.org/10.1016/j.ejmp.2018.09.074