ID de Contribution: **39** Type: **Non spécifié**

# International clinical dosimetry intercomparison - Conclusion and perspectives

*lundi 14 mars 2022 17:00 (20 minutes)*

Nuclear medicine dosimetry implementation depends on the clinical application, dosimetry protocol, software, and eventually the operator. Assessing accuracy & precision in Molecular Radiotherapy (MRT) dosimetry is therefore challenging. This work illustrates some pitfalls encountered even during a very structured analysis, performed by various participants on a single patient dataset using the same CE-marked software and dosimetry procedure.
The clinical dataset, used as a part of IAEA-CRP E23005, was derived from the dosimetric study of a patient administered with Lutathera®. SPECT/CT images were obtained at five time points post injection on a GE Infinia Hawkeye 4. Patient and calibration phantoms were acquired using the same protocol, then reconstructed on a HermesTM workstation.
A standard dosimetric protocol was defined, and PLANET® Dose (v3.1.1) from DOSIsoft SA was installed in nine participating centres to perform the dosimetric analysis of 3 (out of 4) treatment cycles on the reconstructed patient image dataset. The protocol included rigid image registration, segmentation (semi-manual for organs, activity threshold for tumours), absorbed dose point kernel convolution of activity followed by absorbed dose rates (ADR) integration to obtain the absorbed doses (AD). Iterations of the protocol were conducted, with training and brainstorming sessions to analyse dosimetric result variability. Intermediary checkpoints were developed to understand the sources of variation and to differentiate user error from legitimate user variability. Eventually, a real-time clinical dosimetry session was conducted for one cycle at IAEA headquarters with 8 participants in order to reduce the identified sources of errors.

Initial dosimetric results (AD, ADR) for organs (liver & kidneys) and liver lesions showed considerable inter-operator variability (as high as 161%). This necessitated the generation of intermediate checkpoints like total counts, volumes, activity, but also activity-to-counts ratio, activity concentration (AC), and ADR/AC ratio to identify the sources of variability. For the real-time analysis, absorbed doses for normal organs were within 5%, while for lesions, up to 25% variation was observed, mostly due to the choice of the fitting model. Volume differences across organs were reduced to 9.4% (except for right kidney with 14%) and among lesions to 5%. Activity in organs and lesions varied by 10% (excluding 11.5% in right kidneys) and 4.2% respectively, whereas AC and ADR variations dropped below 5%.

Even in a simplified situation where the same patient dataset was analysed using the same dosimetry procedure and software, significant disparities were observed in the results obtained. The results of the real-time multi-centric dosimetry analysis were striking, with most variation sources identified as operator-dependent errors. Variations owing to human error may be minimised by performing intensive training sessions, establishing intermediate checkpoints, conducting sanity checks, and cross-validating results across physicists. This promotes the development of Quality Assurance in clinical dosimetry. This study produced a benchmark dataset, that includes expected results for that dosimetry procedure and that software, and will be made available freely. This will allow individuals to train themselves and increase their proficiency in clinical dosimetry procedures.

**Authors:** KAYAL, Gunjan (CRCT); BARBOSA PARADA, Nathaly (Instituto Nacional de Cancerología ESE, Bogotá, Colombia); CALDERÓN MARÍN, Carlos Fabian (Institute of Oncology and Radiobiology); HIDAYATI, Nur Rahmah (Research Center and Technology for Radiation Safety and Metrology - National Research and Innovation Agency (BRIN), Jakarta, Indonesia); CG MOALOSI, Tumelo (Department of Medical Imaging and Clinical Oncology, Medical Physics, Nuclear Medicine Division, Faculty of Medicine and Health Science, Stellenbosch University, Tygerberg Hospital, South Africa); FERRER, Ludovic (ICO, Nantes); FRAGOSO NEGRÍN, José Alejandro (DOSIsoft SA, Cachan, France & IRCM, UMR 1194 INSERM, Université de Montpellier and Institut Régional du Cancer de Montpellier (ICM), Montpellier, France); GROSEV, Darko (Department of Nuclear Medicine and Radiation Protection, University Hospital Centre Zagreb, Zagreb, Croatia); Dr GUPTA, Santosh Kumar (Department of Nuclear Medicine and PET, Mahamana Pandit Madanmohan Malviya Cancer Centre and Homi Bhabha Cancer Center (a TMC unit) ,Varanasi, UP, India); HOBBS, Robert (Department of Radiation Oncology and Radiation Molecular Sciences, Johns Hopkins Medical Institute, Baltimore, Maryland); POLI, Gian Luca (ASST Papa

Giovanni XXIII, Bergamo, Italy); THAKRAL, Parul (Department of Nuclear Medicine, Fortis Memorial Research Institute, Gurugram, Haryana, India); TSAPAKI, Virginia (Dosimetry and Medical Radiation Physics, International Atomic Energy Agency, Austria ); Dr VAUCLIN, Sébastien (DOSIsoft SA, Cachan, France); VERGARA GIL, Alex (INSERM); Dr KNOLL, Peter (Dosimetry and Medical Radiation Physics, International Atomic Energy Agency, Austria ); BARDIES, Manuel (IRCM Montpellier)

**Orateur:** BARDIES, Manuel (IRCM Montpellier)

**Classification de Session:** Enjeux cliniques

**Classification de thématique:** Enjeux cliniques