TASK GROUP 36
Radiation Dose to Patients in Diagnostic Nuclear Medicine

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Mandate

The ICRP has published over the years several reports on reference dose coefficients for radiopharmaceuticals used in diagnostic nuclear medicine (most recently ICRP Publication 128, 2015).

Task Group (TG) 36 "Radiation Dose to Patients in Diagnostic Nuclear Medicine", which is a joint Task Group of Committee 2 and Committee 3, has the objective to calculate and update dose coefficients for radiopharmaceuticals administered to patients in diagnostic nuclear medicine. This involves using new ICRP adult and paediatric reference voxel phantoms, Publication 107 nuclear decay data and Publication 103 dosimetry methodology as well as developing biokinetic models for new substances and identifying substances contained in Publication 128 where model improvements are needed.

As far as reasonable, a harmonisation of dosimetric and biokinetic models with those developed by TG 95 (IDC) for the ICRP reports on occupational and public exposures is intended.

Task Group 36 meeting in Vienna, September 2023

Main Points

The models adopted in the new ICRP publication present a physiologically more realistic description of the biokinetics of the radiopharmaceuticals. Compartmental models have been developed starting from the previous descriptive models of Publication 128.

If sufficient new information was available about distribution, retention and elimination of the radiopharmaceuticals, more complex models were built. These models have generally a central blood compartment, allow an exchange of material with blood and between compartments, and include physiologically realistic excretion pathways.

For the urinary excretion a dynamic urinary bladder model was used. Stepwise emptying of the urinary bladder at discrete times was assumed. Different emptying schemes can be implemented thus simulating realistic investigation protocols and taking into account day/night cycles. The flowrate can be increased to account for forced hydration.

Special biokinetic and dosimetric models have been introduced for liver and biliary excretion, for cerebrospinal fluid space, and for cases which differ from the reference patient, i.e. when patients of one sex only are involved, or for pathological situations like ablated thyroid, diffuse parenchymal disease or unilateral kidney blockage.

The new dosimetric and biokinetic models were implemented into the computer code IDAC-Dose2.1, considered as the reference benchmark for the work of the TG 36. As part of this process, TG 36 has implemented a quality assurance process to ensure transparency, reproducibility, and traceability of the new dose coefficients. Quality assurance is conducted using software codes developed independently at BfS (German Federal Office for Rdiation Protection), Helmholtz Munich, Memorial Sloan Kettering Cancer Center, ORNL (Oak Ridge National Laboratory) and in collaboration with EURADOS. The issue of model uncertainties was also investigated.

Work Done by TG 36

Within the mandate of TG 36 a free and non-commercial mobile app has been developed. The mobile app is a simple tool, which provides effective dose and organ doses values for intakes of radionuclides for occupationally exposedindividuals, members of the public and for patients in diagnostic nuclear medicine.

In addition to the ICRP dose coefficients, training material is also included in the app. The app can be downloaded via GooglePlay and AppStore by searching for "ICRP Dose viewer" or using the provided QR codes.

ICRP Dose viewer

GET IT ON Google Play

Download on the App Store

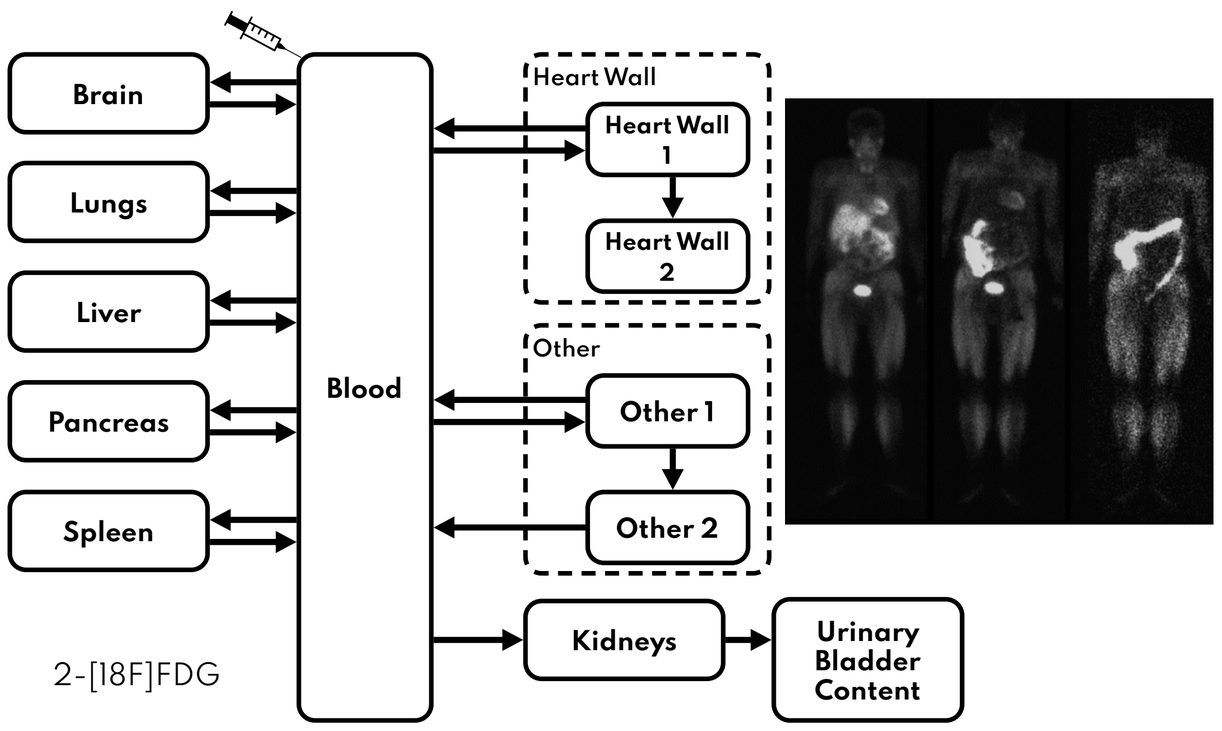

Fig 1. The biokinetic model of 2-[18F]-FDG developed by the Task Group

The work of TG 36 has been presented in scientific journals:

A.Kamp et al. A revised compartmental model for biokinetics and dosimetry of 18F-FDG. EJNMMI Physics 10:20 (2023)

and international conferences:

M.Andersson et al. The ICRP Dose Viewer APP - A mobile app to simplify and improve accessibility of ICRP dose data for intake of radionuclides in patients, staff and members of the public. Medphys 2023, Kaunas, Lithuania. 9-11.11.23.

M.Andersson et al. IDAC-Dose 2.2. An internal dosimetry software for diagnostic nuclear medicine using the ICRP computational framework and calculation of the absorbed dose and effective dose to all 12 ICRP reference individuals. EANM'23, Vienna, Austria, 9-13.9.23.

J.C.Ocampo Ramos et al. ICRP TG36 workflow for updating the reference dose coefficients for diagnostic nuclear medicine and molecular imaging. AAPM 2023, Houston, USA, 23-27.7.23.

M.Andersson et al. IDAC-Dose 2.2. An internal dosimetry program for diagnostic nuclear medicine using the ICRP specific absorbed fractions for the adult and preadult ICRP/ICRU reference computational voxel phantoms. SNMMI 2023, Chicago, USA, 24-27.6.23.

M.Andersson et al. IDAC- BioDose, a complete biokinetic and dosimetric software tool designed for nuclear medicine and built on the ICRP computational framework. NSFS 2023, Malmö, Sweden, 5-9.6.23.

M.Andersson et al. The development of a mobile app to simplify and improve accessibility (for clinical hospital physicists) of ICRP dose data intake of radionuclides in patients, staff and members of the public. NSFS 2023, Malmö, Sweden, 5-9.6.23.

A.Kamp et al. Revision of the reference biokinetic models for dosimetry in diagnostic nuclear medicine. EANM'22, Barcelona, Spain, 15-19.10.22.

A.Giussani et al. Quality Assurance of the revised ICRP dose coefficients to patients from diagnostic radiopharmaceuticals. European Radiation Protection Week 2022, Estoril, Portugal, 9-14.10.22.

A.Giussani. Iodine model – an update. EURADOS Annual Meeting 2022, Belgrade, Serbia, 21.6.22

M.Andersson et al. A revised compartmental model for biokinetics and dosimetry of 18F-FDG. EANM'21, Virtual, 20-23.10.21.

M.Andersson et al. Age dependent dynamic absorbed dose calculations to the urinary bladder wall for ICRP compartmental models of radiopharmaceuticals. ICRP 2019, Adelaide, Australia, 17-21.11.19.