

RADIATION DOSES TO PATIENTS FROM NUCLEAR MEDICINE EXAMINATIONS

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The exposure of the population to ionizing radiation is rising rapidly, nearly exclusively due to increasing medical use of radiation, including diagnostic methods of nuclear medicine. In 2012 Public health authority of the Slovak republic (PHA SR) performed a survey about the population exposure from nuclear medicine procedures. The primary objectives of this survey were to assess the frequency of different nuclear medicine procedures, determine the average activities administered by nuclear medicine procedures and compare them with the national diagnostic reference levels and determine the annual collective effective dose to the Slovak population from nuclear medicine. The effective dose calculation was based on the methodology of the ICRP32, ICRP80 and ICRP106.

In Slovak republic are 11 nuclear medicine departments. The collected data of activities administered by different procedures correspond to 100 % of nuclear medicine departments. The total number of procedures included in the study was 36 250. The most commonly performed procedure was bone scintigraphy (35,9%), followed by lung perfusion and ventilation scintigraphy (17,0%), static and dynamic renal scintigraphy (13,0%), whole-body positron emission tomography of tumors with PET radiopharmaceuticals (11,6%), myocardial perfusion (8,8%), thyroid scintigraphy (6,2%), parathyroid scintigraphy (2,1%), scintigraphy of tumors (2,1%), scintigraphy of the liver and spleen (0,8%), brain perfusion (0,7%) and examination of the gastrointestinal system (0,3%).

The most commonly used radiopharmaceuticals were Tc-99m HDP or MDP for bone studies, F-18 FDG for PET studies, Tc-99m Tetrofosmin for myocardial perfusion, Tc-99m MAA for perfusion lung scintigraphy and for ventilation lung scintigraphy are used Kr-81m. Average activities administered for most frequently performed procedures were 368 MBq F-18 for PET studies, 750 MBq Tc-99m for bone scintigraphy, 115 MBq Tc-99m for lung perfusion scintigraphy, 140 MBq Tc-99m for renal scintigraphy, 605 MBq Tc-99m for parathyroid scintigraphy, 370 MBq Tc-99m for myocardial perfusion, 55 MBq Tc-99m for thyroid scintigraphy, 68 MBq Tc-99m for lymphoscintigraphy and 184 MBq I-123 for brain studies.

Based on the gathered data, the analysis of the nuclear medicine examinations was performed in order to estimate the typical effective dose of each type of examination as well as the collective dose of each group of examinations and their contribution to the total collective dose. The largest contribution to the collective effective dose from nuclear medicine examinations is from the use of Tc-99m radiopharmaceuticals (more as 90%) and from radiopharmaceuticals with isotope F-18. Radiopharmaceuticals with In-111, I-123 and TI-201 have almost negligible contribution to the collective dose. Effective dose for most nuclear medicine procedures varies between 0.3 mSv and 12 mSv. The average effective dose from radiopharmaceuticals per examination determined in this study was 0,3 mSv for lung ventilation (Kr-81m), 0,7 mSv for renal scan, 1,0 mSv for thyroid scan, 1,2 mSv for renal scan, 3,6 mSv for bone scan, 4,6 mSv for myocardial perfusion (Tc-99m), 7,2 mSv for tumors (PET) and 12,6 mSv for myocardial perfusion (TI-201). Bone scan are the biggest contributor to the collective dose of the population in the Slovak republic followed by whole-body positron emission tomography of tumors (PET/CT) and myocardial perfusion scintigraphy.