

ABSORBED DOSE FROM RADIONUCLIDES

There exists the need for a tabulation of the radiation absorbed dose to various organs of the human body from radionuclides administered in nuclear medicine. Such a table has been compiled from the literature available to the authors as of March, 1970.

It should be stressed that the purpose of this table is to indicate the estimated range of the absorbed dose that may result from the administration of a radiopharmaceutical. The range of values found in the table reflects the variation in reported values and does not imply accuracy. Some of the estimates come from individual references but many come from various summary tables. Since, in the latter case, the original sources in the literature may have become obscure, no references are reported here (references available from the authors on request). Unfortunately, most papers on the subject do not cite the biological half-lives which were used for the dose calculations. Therefore no judgment is possible as to the applicability of the data to a particular patient whenever a radionuclide with a physical half-life of more than several hours is administered.

The authors have made no judgments about the accuracy of the reported values in this table and in many cases do not know the assumptions on which the calculations were based. This table should serve only as a guide rather than be a substitute for individual absorbed-dose calculations.

The efforts of several groups such as the Medical Internal Radiation Dose Committee (MIRD) and a subcommittee of the National Council on Radiation Protection and Measurements (NCRP) are directed toward obtaining the best estimates of absorbed dose to humans from radionuclides administered in nuclear medicine. Eventually these groups will provide well-documented data which can be used with confidence.

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A GUIDE TO THE ABSORBED DOSE

Radio-nuclide	Radio-pharmaceutical	Adm. route	Total body	Blood
³ H	Water	i.v. oral	0.1-0.2 0.1-0.2	
¹⁴ C	Monoxide	inhalation*	70	130
¹⁸ F	Sodium fluoride	i.v.	0.05-0.1	
²² Na	Chloride	i.v.	20	
²⁴ Na	Chloride	i.v. oral	1-2 2	
³² P	Sodium phosphate DFP	i.v. i.v.	8-10 1	6 40-50
⁴² K	Chloride	i.v.	1-2	
⁴⁵ Ca	Chloride	i.v. oral	15 9	
⁴⁷ Ca	Chloride	oral i.v.	4 3-7	
⁵¹ Cr	Tagged RBC Tagged RBC altered Sodium chromate EDTA	i.v. i.v. i.v. i.v.	0.1-2 0.2-0.4 0.1-0.3	1-5 0.5-0.7
⁵⁹ Fe	Chloride	oral i.v.	0.3-0.6 3-6	40-50
⁵⁹ Fe	Chloride	oral i.v.	3.5 20-36	77
	Citrate	oral i.v.	3 30	
⁵⁷ Co	Vitamin B ₁₂	oral	2-5	
⁵⁸ Co	Vitamin B ₁₂	oral	20-150	
⁶⁰ Co	Vitamin B ₁₂	oral	240-600	
⁶⁷ Ga	Citrate	i.v.	0.03	
⁷⁵ Se	L-selenomethionine	i.v.	7-9	8-10
⁸⁵ Kr	Gas Saline	inhalation* i.v.		
⁸⁵ Sr	Nitrate Chloride	i.v. i.v.	5-20 5-20	
^{87m} Sr	Nitrate Chloride	i.v. i.v.	0.01 0.01	
^{99m} Tc	Pertechnetate Iron hydroxide Albumin Sulphur-colloid DTPA MAA	i.v. i.v. i.v. i.v. i.v. i.v.	0.01-0.02 0.005 0.01-0.02 0.01-0.02 0.02 0.01-0.02	0.05 0.02 0.03 0.04-0.05
^{118m} In	Iron hydroxide Colloid DTPA	i.v. i.v. i.v.	0.01 0.01 0.01-0.02	0.014 0.03
¹²⁵ I	Sodium iodide	i.v.	0.04	
¹²⁵ I	Sodium iodide Albumin Hippuran MAA	oral i.v. i.v. i.v.	0.04 0.5-0.7 0.01-0.04 0.01	3
¹²⁵ I	Sodium iodide Albumin MAA Rose bengal Hippuran PVP	oral i.v. i.v. i.v. i.v. i.v.	0.5-3.5 1-3 0.1-0.4 0.4-1 0.03-0.2 1-3	0.7-2 5-20 0.5-1.5 0.1
¹²⁵ I	Oleic acid	oral	0.65	
¹²⁵ I	Sodium iodide	oral	0.1-0.2	0.2
¹³³ Xe	Gas Saline	inhalation* i.v.		
			0.0003	
¹²⁵ Cs	Chloride	i.v.	0.15-0.4	
¹⁹⁸ Au	Colloid	i.v.	0.5-2	0.5-0.6
¹⁹⁸ Au	Colloid	i.v.	0.7	
¹⁹⁷ Hg	Chlormerodrin BMHP	i.v. i.v.	0.1 0.08-0.2	0.6
²⁰³ Hg	Chlormerodrin	i.v.	1-2	10

* Inhalation for 1 min of air containing 1 μCi/ml.
† Blocked.

(MILLIRAD/MICROCURIE) FROM INTERNALLY ADMINISTERED RADIONUCLIDES

Bone	Bone marrow	Brain	Gonads	Kidneys	Liver	Lungs	Spleen	Thyroid	Other tissues
0.1-0.3	120		40			80-130	65		Bladder 2-5
10-50	20-40	3			20-30		30		Fetus 1.5-2
50-130		1.5			0.7		1.5		Muscle 1.3
80	15								
20									
15-60	2		0.1-0.3		2-3		3-4		Fetus 0.1-0.2
			0.1-0.4		2		20-50		
			0.01	2-6	8-35		13-24		
				0.03	0.06				
0.5					1.4		2.5		
5	16				14		25		
1.3							15		
13	65				27		27		
	7		3	4	4		2		
	140		150	90	150		230		
			60-140		40-160				
			140		330-500				
			560		1,000-4,200				
0.4				0.2					
			3-7	10-12	30		15-20	5-7	Pancreas 10-12
			0.5						Trachea 70-100
			0.0001				27		Trachea 0.014
30-50							0.005		
30-50									
0.1-0.4	0.1								
		0.006	0.01-0.04	0.1	0.03-0.07			0.1-0.5	Stomach 0.04-0.2
			0.02-0.05	0.8-1	0.5	0.3	0.5		
			0.04						
	0.02-0.03		0.01-0.2		0.2-0.4		0.2-0.5		
			0.01-0.02	0.04					Bladder 0.4-0.6
						0.6-0.8			
	0.02				0.4-0.6		0.08		Bladder 0.4
								16	
								400-1,400	
			0.02-0.3	0.2					
	1.4		2-3		0.2				
			2-9		1.2			1,000-2,000	
			0.3-1.3	6	1.2			20-50 (blocked)	
					0.5-2	4-6	0.3-3	70-200 (unblocked)	
			0.05-0.2	0.1-1	0.7-3				
		0.14	11	12	0.06			130	Bladder 0.4-8
					0.5-8			40	Intestines 20
								10-50	
			1-4			18-35			Fat 9-11
			0.0002-0.04			0.004			Trachea 97
									Fat 0.002
									Trachea 0.02
0.16		0.01	1.2	2	0.4	0.03	0.2		Pancreas 0.08
	2-7		0.4-0.6	8	20-40		8-40		
	1-4		0.1-0.2		10-20		10-40		
			0.08	7	1.5				Bladder 2-3
			0.05-0.2	20-40	0.25-4.5		1-2		
			0.9	60-70	20				Bladder 5