The Ottawa Hospital | L'Hôpital d'Ottawa

Radiation Dosimetry References

PET Isotopes

Cardiac PET Study	Injected Activity* MBq	E* mSv/MBq	**Effective Dose* mSv**	Red Marrow mGy	Gonads mGy	Heart wall mGy	Critical Organ	Dose mGy	Reference
PET F-18-FDG (2D-mode**)	370	0.019	**7.03**	4.1	ovaries=5.55 testes=4.44	23	bladder wall	59	ICRP53 addendum 2 (ICRP80) 2000
PET C-11-acetate (2D-mode**)	550	0.0035	**1.93**	1	ovaries=0.78 testes=0.55	7.2	kidneys	30	ICRP53 addendum4 2001
PET C-11-HED (2D-mode**)	550	0.0054	**2.97**	1.21	ovaries=6.65 testes=3.22	8.5	liver kidneys	10 8.5	Carey and Raffel, uMichigan 2000
PET C-11-rolipram (2D-mode**)	550	0.0018	**0.99**	0.66	ovaries=0.66 testes=0.66	0.66	bladder wall	7.9	Lourenco et al. NMB 2001
PET N-13-ammonia (2D-mode**)	750	0.002	**1.50**	1.28	ovaries=1.28 testes=1.36	1.58	bladder wall kidneys	6.1 3.4	ICRP53 addendum 2 (ICRP80) 2000
PET Rb-82 (2D-mode**)	1500	0.00065	**0.98**	0.56	ovaries=0.57 testes=0.45	2.8	kidneys	13	CardioGen-82 Product Insert 2000
PET CT attenuation scan (smart-mA, auto-mA, noise index=50)			**0.50**						EUR 16262 (DLP x 0.017)

*** Typical values for 70 kg adult.**
** 3D-mode activity is typically 50% of 2D-mode values

The Ottawa Hospital | L'Hôpital d'Ottawa

Nuclear Cardiology SPECT

Cardiac SPECT Study	Injected Activity* MBq	E* mSv/MBq	**Effective Dose* mSv**	Red Marrow mGy	Gonads mGy	Heart wall mGy	Critical Organ	Dose mGy	Reference
Tc-99m-tetrofosmin Rest (1-day protocol)	370	0.0076	**2.8**	1.1	ovaries=3.1 testes=0.9	1.6	gallbladder	1.3	ICRP53 addendum 2 (ICRP80) 2000
Tc-99m-tetrofosmin Rest (2-day protocol)	1100	0.0076	**8.4**	3.3	ovaries=9.3 testes=2.7	4.8	gallbladder	4	ICRP53 addendum 2 (ICRP80) 2000
Tc-99m-tetrofosmin Stress	1100	0.007	**7.7**	3.2	ovaries=8.4 testes=3.2	5.3	gallbladder	3	ICRP53 addendum 2 (ICRP80) 2000
Tc-99m-erythrocytes (RBC)	1100	0.007	**7.7**	6.7	ovaries=4.1 testes=2.5	25	kidneys	20	ICRP53 addendum 2 (ICRP80) 2000
Tl-201	130	0.155	**20.2**	5.8	ovaries=13 testes=27	32	thyroid	70	Thomas et al, JNM 2005;46:502-508
I-123-MIBG	110	0.013	**1.4**	0.7	ovaries=0.9 testes=0.6	2	liver	7.4	ICRP53 addendum 2 (ICRP80) 2000
SPECT CT attenuation scan (1mA - Hawkeye)			**0.4**						EUR 16262 (DLP x 0.017)

*** Typical values for 70 kg adult.**

The Ottawa Hospital | L'Hôpital d'Ottawa

CT Attenuation PET/CT GE Discovery

Cardiac CT Study	**Effective Dose* mSv**
CTA of Native Coronaries (Retrospective ECG Gated) (Prospective ECG Gated)	**13.8 +/- 2.1** **1.7-3.3 (estimated)**
Coronary Calcium Score (Prospective ECG Gated)	**1.8 +/- 0.3**

***** To approximate dose to the average individual, we analysed men and women of "average" body weight (65-75 kg) who had both CTA and Calcium Score performed The reported DLP from the Calcium Score and CTA were averaged and multiplied by 0.014 (Measurement, Reporting & Management of Radiation Dose in CT AND Doses from CT Exams in the UK - 2003 Review

The difference between men and women was < 1 mSv therefore average values are quoted

For studies requiring CTA and Calcium Score, both doses should be added.

The Ottawa Hospital | L'Hôpital d'Ottawa

Nuclear Medicine Studies

Nuclear Medicine Study	Injected Activity MBq	E* mSv/MBq	**Effective Dose* mSv**	Red Marrow mGy	Gonads mGy	Organ mGy	Critical Organ	Dose mGy	Reference
Tc-99m V/Q Tc-99m DTPA	75	0.0069	**0.52**	0.1998	ovaries=0.2442 testes=0.1554	Lungs=1.28	Bladder	3.48	ICRP53
Tc-99m MAA	185	0.011	**2.04**	0.592	ovaries=0.333 testes=0.0011	Liver=2.96	Lung	12.21	ICRP53 addendum 2 (ICRP80) 2000
Tc-99m erythrocytes (RBC)	1100	0.007	**7.7**	6.7	ovaries=4.1 testes=2.5	Heart=25	kidneys	20	ICRP53 addendum 2 (ICRP80) 2000
Tc-99m MDP Bone	925	0.0057	**5.27**	8.51	ovaries=3.33 testes=2.22	Kidneys=6.75	Bone Surface	58.28	ICRP53 addendum 2 (ICRP80) 2000
PET-18-FDG Oncology	444	0.0189	**8.43**	4.88	ovaries=6.66 testes=5.33	Heart=27.5	Bladder	71.04	ICRP53 addendum 2 (ICRP80) 2000

*** Typical values for 70 kg adult.**

CT Attenuation PET/CT Phillips Gemini

PET / CT Effective Dose	**4.5 mSv**

ImPACT CT Patient Dosimetry Calculator

Version 0.99x 20/01/06

Scanner Model:			
Manufacturer:	Philips		
Scanner:	MX 8000		
kV:	120		
Scan Region:	Body		
Data Set	MCSET23	Update Data Set	
Current Data	MCSET23		
Scan range			
Start Position	-10	cm	Get From Phantom Diagram
End Position	88.5	cm	
Patient Sex:			

Acquisition Parameters:			
Tube current		80	mA
Rotation time		0.5	s
mAs / Rotation		40	mAs
Collimation		10	mm
Slice Width		5	mm
Pitch		1	
Rel. CTDI	Look up	1.00	at selected collimation
CTDI (air)	Look up	19.9	mGy/100mAs
CTDI (soft tissue)		21.3	mGy/100mAs
$_nCTDI_w$	Look up	7.8	mGy/100mAs

Organ	w_T	H_T	$w_T.H_T$
Gonads	0.2	4.5	0.9
Bone Marrow (red)	0.12	3.5	0.42
Colon	0.12	4	0.48
Lung	0.12	5	0.6
Stomach	0.12	4.6	0.55
Bladder	0.05	4.8	0.24
Breast	0.05	3.9	0.2
Liver	0.05	4.5	0.22
Oesophagus (Thymus)	0.05	5.4	0.27
Thyroid	0.05	6.9	0.34
Skin	0.01	3.1	0.031
Bone Surface	0.01	6.8	0.068
Remainder 1	0.025	3.6	0.089
Remainder 2	0.025	3.6	0.089
Total Effective Dose (mSv)			**4.5**

Remainder Organs	H_T
Adrenals	4.3
Brain	3.5
Upper Large Intestine	4.3
Small Intestine	4.3
Kidney	4.8
Pancreas	4.1
Spleen	4.4
Thymus	5.4
Uterus	4.3
Muscle	3.5

$CTDI_w$ (mGy)	3.1
$CDTI_{vol}$ (mGy)	3.1
DLP (mGy.cm)	309

Scan Description / Comments	Assumed pitch of unity. 2 x 5 mm slices

Typical Effective Doses from Diagnostic Medical Exposure

Table 1. Typical Effective Doses from Diagnostic Medical exposure in the 2000s (21)

Diagnostic Procedure	Typical Effective Dose (mSv)	Equiv. # of Chest x-rays	Approx. equiv. Period of natural background radiation(a)
Radiographic examinations:			
Limbs and joints (except hip)	< 0.01	< 0.5	< 1.5 days
Chest (single PA)	0.02	1	3 days
Skull	0.06	3	9 days
Thoracic Spine	0.07	35	4 months
Lumbar Spine	1.0	50	5 months
Hip	0.4	20	2 months
Pelvis	0.7	35	4 months
Abdomen	0.7	35	4 months
IVU/IVP	2.4	120	14 months
Barium Swallow	1.5	75	8 months
Barium Meal (UGI)	2.6	130	15 months
Barium follow-through	3.0	150	16 months
Barium enema	7.2	360	3.2 years
CT Head	2.0	100	10 months
CT Chest	8.0	400	3.6 years
CT Abdomen or Pelvis	10	500	4.5 years

(a) Canadian average background radiation = 2.2 mSv per year; regional average range from 2.0 to 4.0 mSv per year.

For Ottawa - average background = 2.8 mSv per year

Source: National Radiation Protection Board. Radiation Exposure of the UK Population from Medical and Dental X-Ray Examinations, NRPB-W4 (ISBN 0 85951 468 4). NRPB. Didcot. 2001