



Penn
UNIVERSITY of PENNSYLVANIA

*Environmental Health and
Radiation Safety*

***Information About Radiation
from
Diagnostic Imaging Procedures***

Diagnostic Imaging Modalities

- I. [General Radiography](#)
- II. [Computed Tomography \(CT\)](#)
- III. [Nuclear Medicine](#)
- IV. [Fluoroscopy](#)

General Radiography

<u>Imaging Procedure</u>	<u>Radiation Effective Dose</u> *
Skull	< 0.1 mSv
Spine	< 0.6 mSv
Chest	< 0.2 mSv
Abdomen	< 1.0 mSv
Upper Extremities	< 0.1 mSv
Lower Extremities	< 0.1 mSv
DEXA	< 0.01 mSv
PQCT	< 0.01 mSv

* 1 mSv = 100 mrem

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

Radiation doses are calculated based on information provided by the HUP Radiology Department

For additional information contact: dosimetry@lists.upenn.edu

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Computed Tomography (CT)

Common Imaging Regions:

- I. [Head / Neck](#)
- II. [Body](#)

CT: Head / Neck

<u>Imaging Procedure</u>	<u>Radiation Effective Dose</u> *
Head**	3 mSv
Angio Head Combined- CANH	1 mSv
Maxillary Unenhanced- CTFU	3 mSv
Neck- CTNE / CTNU**	3 mSv
C-spine Unenhanced- CCSU	4 mSv

* 1 mSv = 100 mrem

** Enhanced (Contrast) or Unenhanced

Average dose to individual in US from natural background radiation: 3.0 mSv/year

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CT: Body

<u>Imaging Procedure</u>	<u>Radiation Effective Dose</u> *
Chest CTCE / CTCU**	5 mSv
CHEST IV Contrast Pulmonary- CTEPE	10 mSv
Heart IV Contrast Coronary Arteries- CCC	2 mSv
Cardiac-Pulmonary Vein	30 mSv
Angio Abdomen Combined- CANA	17 mSv
Abdomen/Pelvis**	10 mSv

* 1 mSv = 100 mrem

** Enhanced (Contrast) or Unenhanced

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Nuclear Medicine

Common Imaging Procedures:

- I. [Cardiac](#)
- II. [Vascular](#)
- III. [CNS](#)
- IV. [Endocrine](#)
- V. [Gastrointestinal](#)
- VI. [Genitourinary](#)
- VII. [Pulmonary](#)
- VIII. [Skeletal](#)
- IX. [Infection / Inflammation](#)
- X. [Oncologic](#)
- XI. [PET/CT](#)

NM: Cardiac

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
MUGA w/ EF	^{99m} Tc-PYP	7 mSv
Myocardial Perfusion Rest/Stress	^{99m} Tc-Sestamibi	23 mSv ^{**†}
Thallium Rest / Stress (Perfusion/Viability)	²⁰¹ Tl-chloride	45 mSv ^{**}
Thallium Rest / Redistribution	²⁰¹ Tl-chloride	36 mSv ^{**}
Cardiac Shunt	^{99m} Tc-Pertechnetate	12 mSv
First Pass	^{99m} Tc-Pertechnetate	12 mSv

* 1 mSv = 100 mrem

** Includes CT dose from SPECT/CT

† 2 day studies are ~8 mSv greater than the 1 day study listed

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Vascular

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
WB Blood Pool	^{99m} Tc-Ultratag RBC	8 mSv
Extremity Venous Flow	^{99m} Tc-Pertechnetate	10 mSv
Lymphoscintigraphy	^{99m} Tc-Sulfur colloid	< 0.1 mSv

* 1 mSv = 100 mrem

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: CNS

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
Brain Flow / Brain Death	^{99m}Tc -ECD or HMPAO	9 / 10 mSv
Brain Perfusion	^{99m}Tc -ECD or HMPAO	9 / 10 mSv
Brain Perfusion w/ Diamox	^{99m}Tc - ECD or HMPAO	11 / 14 mSv [†]
Brain SPECT	^{99m}Tc -Sestamibi	10 mSv
Brain SPECT	^{201}Tl -chloride	0.3 Sv
Cisternogram	^{111}In -DTPA	3 mSv
Cisternogram	^{99m}Tc -DTPA	1 mSv
Ventriculoperitoneal Shunt Patency	^{111}In -DTPA	< 1 mSv
DaTscan Brain SPECT	^{123}I -Ioflupane	6 – 10 mSv

* 1 mSv = 100 mrem

† 2 day studies are ~6.5 mSv greater than the 1 day study listed

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Endocrine

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
Thyroid Uptake and/or Scan	^{123}I	1 mSv
Thyroid Scan Only	$^{99\text{m}}\text{Tc}$ -Pertechnetate	5 mSv
WB Iodide Scintigraphy	^{123}I	8 mSv
WB Iodide Scintigraphy	^{131}I	2 Sv
Parathyroid	$^{99\text{m}}\text{Tc}$ -Sestamibi	8 mSv**

* 1 mSv = 100 mrem

** Includes CT dose from SPECT/CT

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Gastrointestinal

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
Salivary Gland	^{99m} Tc-Pertechnetate	5 mSv
Esophageal Transit	^{99m} Tc-Sulfur Colloid	1 mSv
GE Reflux	^{99m} Tc-Sulfur Colloid	1 mSv
Liquid Gastric emptying	^{99m} Tc-DTPA	1 mSv
Solid Gastric emptying	^{99m} Tc-Sulfur Colloid	1 mSv
Dual Phase Gastric Emptying	^{99m} Tc-Sulfur colloid & ¹¹¹ In-DTPA	7 mSv
GI bleed	^{99m} Tc-Ulratag RBC	8 mSv
Meckels Diverticulum	^{99m} Tc-Pertechnetate	10 mSv
Hepatic Blood Pool (Hemangioma)	^{99m} Tc-Ulratag RBC	8 mSv
Hepatic Artery Infusion Pump Study	^{99m} Tc-MAA & Sulfur Colloid	4 mSv
Hepatic Artery Study (pre-spheres)	^{99m} Tc-MAA & Sulfur Colloid	7 mSv**
Liver / Spleen	^{99m} Tc-Sulfur Colloid	4 mSv
HIDA	^{99m} Tc-Mebrofenin	3 mSv
Pancreatic Transplant	^{99m} Tc-DTPA	4 mSv

* 1 mSv = 100 mrem

** Includes CT dose from SPECT/CT

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Genitourinary

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose*</u>
Renogram	^{99m}Tc -MAG3	2 mSv
Renogram	^{99m}Tc -DTPA	2 mSv
Captopril Renogram	^{99m}Tc -MAG3	2 mSv
Renal Transplant	^{99m}Tc -MAG3	2 mSv
Renal Transplant	^{99m}Tc -DTPA	2 mSv
Renal Cortical Scintigraphy	^{99m}Tc -DMSA	3 mSv
GFR Measurement	^{99m}Tc -DTPA	1 mSv
Voiding Cystogram	^{99m}Tc -Sulfur Colloid	1 mSv
Testicular Scintigraphy	^{99m}Tc -DTPA	5 mSv

* 1 mSv = 100 mrem

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Pulmonary

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
Lung Ventilation	^{133}Xe	< 1.0 mSv
Lung Ventilation	$^{99\text{m}}\text{Tc}$ -DTPA (aerosol)	8 mSv
Lung Perfusion	$^{99\text{m}}\text{Tc}$ -MAA	2 mSv
VQ for PE	$^{99\text{m}}\text{Tc}$ -MAA & DTPA (aerosol) or ^{133}Xe	2 - 9 mSv
Pregnant Patient Lung Perfusion	$^{99\text{m}}\text{Tc}$ -MAA	< 1 mSv

* 1 mSv = 100 mrem

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Skeletal

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
WB Bone	^{99m} Tc-MDP	5 mSv
3-phase Bone	^{99m} Tc-MDP	5 mSv
Bone Marrow	^{99m} Tc-Sulfur Colloid	4 mSv

* 1 mSv = 100 mrem

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Infection / Inflammation

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
Fever or Bacteria of Unknown Origin	^{111}In -WBC	7 mSv**
Osteomyelitis	^{111}In -WBC & $^{99\text{m}}\text{Tc}$ -Sulfur Colloid	10 mSv
Gallium Scan	^{67}Ga -citrate	30 mSv**

* 1 mSv = 100 mrem

** This effective dose does not reflect any additional dose from CT if done on a SPECT/CT

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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NM: Oncologic

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose</u> *
Prostascint Study	¹¹¹ In-Prostascint	41 mSv**
MIBG	¹²³ I-MIBG	5 mSv [†]
MIBG	¹³¹ I-MIBG	3 mSv [†]
Malignancy or Sarcoid	⁶⁷ Ga-citrate	30 mSv
Octreoscan	¹¹¹ In-Pentetreotide	12 mSv**

* 1 mSv = 100 mrem

** Does not include CT dose from SPECT/CT due to variations in scan region for individual patients.

[†] Non-therapeutic doses

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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PET/CT

<u>Imaging Procedure</u>	<u>Radiopharmaceutical</u>	<u>Radiation Effective Dose*</u>
Oncologic Whole Body	^{18}F -FDG	24 mSv
Myocardial Sarcoid	^{18}F -FDG	11 mSv
Myocardial Viability	^{18}F -FDG	11 mSv
Myocardial Perfusion PET/CT Rest/Stress	^{82}Rb -chloride	2 mSv
Brain	^{18}F -FDG	12 mSv

* 1 mSv = 100 mrem

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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Fluoroscopy

<u>Imaging Procedure</u>	<u>Radiation Effective Dose</u> * †
O-Arm 3D mode: head **	< 1 mSv / rotation
O-Arm 3D mode: chest **	4 mSv / rotation
O-Arm 3D mode: abdomen **	4 mSv / rotation

* 1 mSv = 100 mrem

† These are general dose estimates based on typical technique settings and may vary significantly by patient.

** Dose estimates are based on the medium patient technique settings.

Average dose to individual in US from natural background radiation: 3.0 mSv/year

Average dose to individual in US from all sources of radiation: 6.2 mSv/year

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