

BE SMART ABOUT MEDICAL IMAGING

Frequently Asked Questions about Radiation Used in Medical Imaging

In the late 19th Century, a German scientist accidentally discovered that radiation could see through solid objects, including human tissue. Since that historic day, radiation has become a common and widely used method of visualizing the inside of objects in many industries, including construction, engineering, manufacturing and transportation. In health care, it is a valuable tool to screen for, diagnose and treat numerous medical and dental conditions. As new technologies have increased the use of radiation, there also has been increased attention to avoid over exposure and the associated risks.

What is radiation?

Radiation – something that cannot be seen or felt – is a naturally occurring part of our environment. It is a form of energy that is transmitted as particles or electromagnetic waves. Shortly after the discovery of radiation and its use in creating images of the interior of objects, an American medical student discovered that significantly higher levels of radiation could be used to destroy cancer.

Where does radiation come from?

Most of our exposure to radiation comes from natural resources (the earth, the universe, air, food, water, radon, etc.). This is called “background” radiation. The remaining exposure to radiation comes from medical procedures, consumer products (such as tobacco, fertilizer, welding rods, smoke detectors, computer monitors, luminous watch dials, etc.), air travel, power plants and industry, and possibly a person’s work environment.

What is a safe level of radiation exposure?

Radiation is measured in units called rems and millirems. A millirem is 1/1000th of a rem. The average annual dose per person from background radiation is about 310 millirems. Radiation from medical procedures accounts for approximately 300 additional millirems per person annually.¹ During the last three decades, this type of exposure has increased, primarily because of new, more advanced medical imaging. Nevertheless, the total annual exposure from all sources remains far less than the 5000 millirems set by the United States Nuclear Regulatory Commission as the safe limit for people who work with or around radioactive material.²

What medical procedures use radiation?

Numerous diagnostic tests and treatment therapies use radiation. For many diseases, these tests and therapies have reduced the need for surgery and dramatically increased life expectancy.

Diagnostic tests that use radiation include: radiography (X-rays), fluoroscopy, nuclear medicine, positron emission tomography (PET), computed tomography (CT), intraoperative imaging and mammography.

Radiation therapies that are used to treat various forms of cancer include procedures such as brachytherapy, stereotactic radiosurgery, volumetric modulated arc therapy (VMAT), image-guided radiation therapy (IGRT) and intensity-modulated radiation therapy (IMRT).

MRI and ultrasound imaging do not use radiation.

How much radiation do we get from medical/dental imaging?

The amount of radiation exposure from medical and dental imaging depends on a person's medical condition and the type of diagnostic tests he or she receives. The amount of radiation also varies greatly among procedures.

Radiation exposure for some of the more common imaging procedures^{3, 4, 6} includes:

Dental X-ray – .5 millirems	CT scan (head) – 200 millirems
Dental X-ray (panoramic) – 1 millirem	CT scan (chest/abdominal/pelvis) – 1,800 millirems
Chest X-ray – 10 millirems	PET/CT (chest/abdominal/pelvis) – 2,800 millirems
Hip X-ray – 80 millirems	Bone density scan (DEXA) – .04 millirems
Mammogram – 40-70 millirems	Bone scans (Tc99m MDP) – 630 millirems
BSGI – 666 millirems	PET (various studies with 18F FDG) – 1,000 millirems

What is the risk associated with radiation imaging exposure?

Our bodies usually are able to rapidly repair the damage to our cells from the small amount of background radiation we receive each day. Because there are so many variables, it is difficult to specifically calculate the potential risk from exposure to other sources of radiation, including medical imaging. Your personal risk will depend on your age, where you live and work, your lifestyle, and the type and number of diagnostic imaging procedures you have had in your lifetime.

There is a small increased risk of developing cancer later in life that is associated with higher doses of radiation used in some types of medical imaging or with accumulated radiation. It is important to remember, however, that your doctor is charged with carefully weighing the risks and benefits before determining a procedure is medically necessary. Usually the benefits of early detection far outweigh any increased risk.⁵

How do health-care facilities protect patients from over exposure?

Professional organizations, hospitals, and medical and dental offices have developed detailed clinical guidelines that describe the recommended dose for each medical imaging procedure. State and Federal regulations have set standards for equipment calibration and monitoring. Faster-speed film for dental X-rays, as well as the advent of digital imaging, has helped lower the radiation dose for some procedures. The overarching guideline is to administer the optimal dose – not too much and not too little – to produce a high-quality image. The goal is always to give each patient the right imaging exam, at the right time, with the right radiation dose.³

What can you do to protect yourself and your family?

Medical imaging is an extraordinary health-care tool that is extremely beneficial. You can help ensure your safety by remembering to **be SMART about medical imaging**.

Seek information

(Learn about monitoring and protecting yourself and your children from over exposure to all types of radiation.)

Make informed decisions

(Carefully evaluate imaging options with your doctor.)

Ask your doctor to explain his or her decisions

(Is this the only imaging option? How will it help me? How much radiation will be used? What are the risks?)

Record radiation procedures

(Keep track of your medical imaging, as well as any radiation therapy you may receive.)

Tell health-care providers about previous procedures

(Be sure to share information about previous X-rays, scans or therapies with all of your health-care providers.)

Resources:

1 National Council of Radiation Protection and Measurement, *NCRP Report No. 160*, March 2009

2 United States Nuclear Regulatory Commission, *Fact Sheet on Biological Effects of Radiation*, December 2004

3 U.S. Food and Drug Administration, Center for Devices and Radiological Health, *Initiative to Reduce Unnecessary Radiation Exposure from Medical Imaging*, February 2010

4 Health Physics Society, *Radiation from Medical Diagnostic Imaging Procedures Fact Sheet*

5 U.S. Food and Drug Administration, Consumer Health Information, *Reducing Radiation from Medical X-rays*

6 <http://www.doseinfo-radar.com/RADARDoseRiskCalc.html>