



## X-ray, Interventional Radiology and Nuclear Medicine Radiation Safety

### X-ray safety

As with other medical procedures, x-rays are safe when used with care. Radiologists and x-ray technologists have been trained to use the minimum amount of radiation necessary to obtain the needed results. Properly conducted imaging carries minimal risks and should be performed when clinically indicated. The amount of radiation used in most examinations is very small and the benefits greatly outweigh the risk of harm.



X-rays are produced only when a switch is momentarily turned on. As with visible light, no radiation remains after the switch is turned off.

See the Radiation Dose in X-ray and CT Exams page for more information about radiation dose.

### X-rays over your lifetime

The decision to have an x-ray exam is a medical one, based on the likelihood of benefit from the exam and the potential risk from radiation. For low dose examinations, usually those that involve only films taken by a technologist, this is generally an easy decision. For higher dose exams such as computed tomography (CT) scans, interventional radiology, and nuclear medicine procedures, the radiologist may want to consider your past history of exposure to x-rays. If you have had frequent x-ray exams and change healthcare providers, it is a good idea to keep a record of your x-ray history for yourself. This can help your doctor make an informed decision. It is also very important to tell your doctor if you are pregnant before having an exam that involves the abdomen or pelvic region.

There have been a number of studies linking current or future cancers to previous x-ray imaging studies, especially CT scans. These studies have important limitations in that they lack key data, including: direct radiation exposure measurements for each patient; why the patient underwent the study; and what beneficial information was derived from the CT scan. In addition, underlying statistical models can be

fraught with tremendous levels of uncertainty. Nevertheless, these studies are valuable as they highlight the importance of optimizing CT scan techniques and have led to advancements that are resulting in much lower radiation exposures for similar CT studies. It is important to know why you need the CT scan and to discuss with your doctor whether CT is the most appropriate test to answer the medical question. Sometimes, there are alternative exams that do not use radiation. In most cases, the benefit of detecting immediate and potentially life-threatening disease or injury far outweighs any concerns about the possible risks of future cancer.

See the [Radiation Dose in X-ray and CT Exams](#) page for more information about radiation dose.

#### References:

1. Pearce MS, Salotti JA, Little MP, et al., Radiation exposure from CT scans in childhood and subsequent risk of leukaemia and brain tumours: a retrospective cohort study. *Lancet*. 2012; 380: 499–505.
2. Mathews JD, Forsythe AV, Bardy Z, et al., Cancer risk in 680 000 people exposed to computed tomography scans in childhood or adolescence: data linkage study of 11 million Australians. *BMJ* 2013; 346:f2360.
3. Huang WY, Muo CH, Lin CY, et al., Paediatric head CT scan and subsequent risk of malignancy and benign brain tumour: A nation-wide population-based cohort study. *British Journal of Cancer* (2014), 1–7 | doi: 10.1038/bjc.2014.103.

## Pregnancy and x-rays

As with any aspect of medical care, knowing that a patient is or could be pregnant is important information. Pregnancy, for example, might explain certain symptoms or medical findings. When a pregnant patient is ill or injured, the physician will carefully select medications to avoid potential risks to the developing child. This is also true of x-rays.

While the vast majority of medical x-rays do not pose a critical risk to a developing child, there may be a small likelihood of causing a serious illness or other complication. The actual risk depends on how far along the pregnancy is and on the type of x-ray. Ultrasound studies, for example, don't use x-rays and have never demonstrated any potential risk to pregnancy. X-ray studies of the head, arms, legs and chest do not usually expose the baby directly to x-rays and typically the technologist who takes the x-rays will implement special precautions to ensure that the baby of a pregnant patient is not directly exposed.

Sometimes patients need examinations of the abdomen or pelvis while they are pregnant. When studies of the abdomen or pelvis are required, the physician may prefer to order a different type of exam for a pregnant patient or reduce the number of x-rays from that which is normally acquired. Therefore, it is important that you inform your physician or the x-ray technologist about your reproductive status before the x-ray study is performed.

Most standard x-ray examinations of the abdomen are not likely to pose a serious risk to the child. Some abdominal and pelvic studies such as CT deliver greater amounts of radiation to a developing pregnancy. Informing the radiologist that you are or might be pregnant is important so that your medical care can be planned with both you and your baby in mind. Remember, this is done to optimize medical care by reducing any potential risk. See the [CT During Pregnancy](#) page for additional information.

Radionuclide exams, also known as nuclear medicine, use an x-ray-like radiation. The method of use, however, is quite different from x-rays and produces very different looking images. The same advice for informing your physician or the nuclear medicine technologist about any possible pregnancy before the

examination begins is important.

See the General Nuclear Medicine page for additional information.

However, in nuclear medicine another precaution is advised for women who are breast-feeding a child. Some of the pharmaceuticals that are used for the study can pass into the mother's milk and subsequently the child will consume them. To avoid this possibility, it is important that a nursing mother inform her physician and the nuclear medicine technologist about this before the examination begins.

See the Contrast Materials page for more information about pregnancy and contrast materials.

See the Radiation Dose in X-ray and CT Exams page for more information about radiation dose.

## **Radiation dose from interventional radiology procedures**

Interventional radiologic procedures use diagnostic-type imaging equipment to assist a physician in the treatment of a patient's condition. These procedures frequently provide favorable medical results with minimal recovery time. In some cases these procedures avoid the need for conventional surgery or improve the prospects for a favorable outcome from surgery. As with any medical procedure, there are associated risks and the nature of these risks depend on the procedure.

With interventional radiology procedures using x-rays, the level of risk depends on the type of procedure because some use very little radiation, while complex procedures use much more. In general, the risk of developing a cancer from the exposure is not a major concern when compared to the benefits of the procedure. Many of the complex procedures, such as ones used to open a partially blocked blood vessel, repair a weak area of a bulging vessel, or to direct blood flow through malformed vessels, use extensive radiation. But such complex procedures are also frequently lifesaving in their benefit and the risks associated with the radiation are of secondary consideration. In very rare cases, some patients develop skin damage as a result of the procedure. As with any surgical procedure, these rare events are important possibilities to consider when procedures are difficult and extensive. Since the risk for such complications depends on the individual circumstances, the physician should discuss these possibilities with the patient as is appropriate.

Ultrasound imaging is sometimes used for interventional radiology procedures. Ultrasound uses high frequency sound waves and, at current intensities, no risk is known to exist for this type of imaging procedure. Magnetic resonance imaging is used for other interventional radiology procedures. For these procedures, a careful screening is performed prior to admission to the scanner room. This screening is to make sure that you have not had previous medical or cosmetic procedures that might make the procedure hazardous. See the Magnetic Resonance Imaging (MRI) Safety page for more information.

See the Radiation Dose in X-ray and CT Exams page for more information about radiation dose.

## **Safety in nuclear medicine procedures**

Nuclear medicine is a branch of medical imaging that uses small amounts of radioactive material to

diagnose and determine the severity of or treat a variety of diseases, including many types of cancers, heart disease and certain other abnormalities within the body.

Depending on the type of nuclear medicine exam, the radioactive material, or radiotracer, may be injected into a vein, swallowed or inhaled as a gas. The radiotracer will accumulate in the organ or area of the body being examined, where it gives off energy in the form of gamma rays, allowing the radiologist or nuclear medicine physician to view structural and functional information about organs or tissues within the body.

During nuclear medicine exams, patients are exposed to some radiation from the radiotracer and may be exposed to additional radiation, depending on the imaging method used during the procedure. Though the exact amount of radiation exposure can vary, based on the patient's physical dimensions and the part of the body being examined, radiologists and nuclear medicine physicians will use the lowest dose possible in order to obtain the highest quality images.

Nuclear imaging exams can be performed safely on children and pregnant women as long as the benefits outweigh the small associated radiation risk. When performing such exams, careful evaluation should be done to ensure proper/optimal dosage is given. Women should always inform their physician or technologist if there is any possibility that they are pregnant or if they are breastfeeding.

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