X-rays
How safe are they?

Patient Information

Welcome to exceptional healthcare

Benefit versus risk

X-ray examinations are "prescribed" by the referring doctor in much the same way that pharmaceutical drugs and medicines are prescribed. The "prescribing" of X-ray examinations is, therefore, based on clinical need. The referrer who requests the X-ray does so on the principle that the benefit of having a certain X-ray examination outweighs the risk of not having that examination. X-ray examinations are therefore only performed when absolutely necessary.

X-ray equipment and safety

Radiography: The images are formed by passing an X-ray beam through some section of your body such as bones, chest or teeth and are recorded either on film or some form of digital media. Most radiography examinations involve small amounts of radiation (see Table 1).

Fluoroscopy: This is an imaging technique using a continuous X-ray beam to obtain real-time moving images of the internal structures of your body. In most fluoroscopy examinations you will be asked to swallow a contrast agent, which is shown up well by X-rays. Fluoroscopy examinations usually involve higher radiation doses compared to radiography (see Table 1).

Computed Tomography (CT): During a CT scan you will lie on a table that is attached to the CT scanner, which is a large doughnut-shaped machine. The CT scanner sends X-rays through a slice of your body on to a bank of detectors. The X-ray source and the detectors rotate around inside the machine. Each rotation of the scanner provides a picture of a thin slice of the organ or area. All the pictures are saved as a group in a computer. The radiation dose of a CT scan can be as high as or higher than that for fluoroscopy (please see Table 1).

Nuclear Medicine: In this modality, a small amount of radioactive material (radiopharmaceutical) is injected into your vein to diagnose and treat disease. The radioactive material emits gamma rays which are detected by special types of cameras that work with a computer to provide pictures of the area of the body being imaged.

All X-ray equipment is constantly being improved and updated. It has become more sensitive over the years and this ensures that radiation doses are kept to the minimum necessary to achieve a diagnostic result.

The X-ray equipment in this department is subject to annual, independent safety tests by the Radiological Protection Centre. It is maintained regularly by the manufacturer and the staff undertake their own programme of quality control. All these steps are national requirements in the interests of patient and staff safety.

Radiation dose

When X-rays are taken, some of the energy in the X-ray beam is absorbed in the body. This is called the radiation dose, often shortened to ‘dose’. It can be expressed in a number of different ways. The most common quantity is the ‘effective dose’ measured in Sievert (Sv). Because diagnostic X-ray examinations involve relatively low doses, these doses are stated in milliSievert (mSv); in other words, one thousandth of a Sievert.

National standards

The use of X-rays in hospitals is subject to both national regulations and department rules. An indication of the dose is recorded for every X-ray examination and these are routinely audited against national and local reference levels.

Adult doses and risk with age

National studies have enabled average doses for adults for different examinations to be estimated as shown in Table 1. Doses are expressed in units of milliSievert and also in terms of the equivalent number of years of background radiation. This helps to put the dose you receive from your X-ray examination into context Radiation-induced cancers typically take many years to develop so risks are slightly lower for older patients than they are for children and unborn babies. Special precautions are taken with females where there is a possibility of pregnancy and where the womb is near the beam of radiation. If the examination is considered to be necessary then the risk to health from not performing it is likely to be much greater than the risk from the radiation itself.

Background radiation

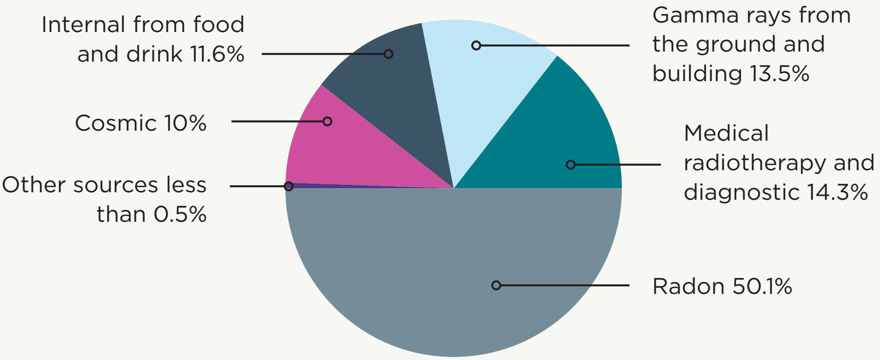
Background radiation comes from the sun, the food we eat, building materials and natural surroundings like earth and rocks.

The dose varies in different parts of the United Kingdom but in average it amounts to an effective dose of about 2.5mSv per year, but varies. For example, background radiation dose in London is also about 2mSv per year, whereas in Cornwall, the background radiation dose is about 7msv per year on average.

It could therefore be argued that a patient who undergoes a relatively complex examination, such as an intravenous urogram (IVU) receives a radiation dose equivalent to the extra dose they would receive if they moved from London to live in Cornwall for six months.

A simpler examination, such as a chest X-ray, would involve a much smaller dose of radiation equivalent to about 4 days' of average background radiation.

Figure 1: Typical doses of background radiation



Radiation risk in perspective

There is a theoretical possibility that an X-ray examination can induce cancer. However, low dose examinations like the ones in Table 1 present a risk of only about 1 in 1,000,000. When we compare the risk of cancer induction from high dose procedures like CT or a Barium Enema (approximately 1 in 10000 to 1 in 1000 risk) with the natural lifetime risk of cancer of 1 in 4, we can see that the risks from these examinations are very small compared to the natural risk of the disease.

If you would like any additional information or have any concerns, please ask to speak to the Imaging Manager.

Table 1: Typical Doses for Adults from Diagnostic X-ray Examinations

Dose	Examination	Effective Dose (mSv)	Equivalent Time of Average Background Radiation)
Low Dose	Dental	0.01	2 days
	Chest	0.02	4 days
	Skull	0.03	6 days
Medium Dose	Mammography	0.6	4 months
	Lumbar Spine	0.7	4.5 months
	Pelvis	0.7	4.5 months
	Abdomen	0.7	4.5 months
High Dose	CT Head	3	1.5 years
	CT Chest / Abdo / Pelvis	22	11 years
	IVU	2.4	1.5 years
	Barium Meal	2.6	1.2 years
	Barium Enema	7.2	3.6 years
	Nuclear Medicine	0.5 – 10	0.3 – 5 years

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