Government of Western Australia
Department of Health

Radiation and Pregnancy

Environmental Health Guide

Are you pregnant and about to have an x-ray or nuclear medicine examination? Perhaps you are pregnant and you work with ionising radiation, primarily x-rays and gamma rays. Is that radiation exposure likely to affect the baby's development and its future health? The qualified answer is "no".

For most diagnostic x-ray examinations, nuclear medicine scans and most occupational radiation exposure, the potential radiation dose is likely to be low and of little significance during pregnancy. Nevertheless, in endeavouring to minimise radiation exposure, health authorities accept the premise that any exposure to ionising radiation carries a risk. In this case, an increased risk of cancer for the mother and baby in later life.

This premise is based on studies which have revealed effects linked to high radiation doses, such as those on the populations of Hiroshima and Nagasaki who survived the exposure of radiation from nuclear weapons.

The risk from low radiation doses

When recommending radiation protection measures, the International Commission on Radiological Protection and other expert bodies, start with the known cancer risk from high doses and, working backwards, estimate the risk that might apply at the much lower doses used in most diagnostic x-ray and nuclear medicine procedures.

Recent research on Hiroshima and Nagasaki survivors who received low doses indicates that this is probably a valid approach.

During the term of a pregnancy, the baby inevitably receives a radiation dose from a range of naturally occurring sources, including the naturally occurring radioactive substances within the mother's body.

Radiation doses are measured in units called milligrays (abbreviated as mGy). Natural background radiation gives each of us a radiation dose of perhaps 1 to 2 mGy each year.

Generic effects

Experimental studies on plants and animals suggest that genetic effects can occur but the International Commission on Radiological Protection, Publication 60, 1990 reports that radiation exposure has not been identified as a cause of such effects in humans.

Diagnostic x-ray examinations

The total radiation dose that a patient receives during an x-ray examination is dependent on many technical and physical factors as well as the skill of the person operating the x-ray equipment. The operator's qualifications are prescribed in regulations to the State's Radiation Safety Act.

With few exceptions, there are no dose limits prescribed for patients undergoing x-ray examinations. effects in humans have yet been discovered despite detailed and continuing studies of exposed populations.

Postponing or modifying the x-ray examination

Where pregnancy has been confirmed, it may be desirable to postpone an x-ray examination until after the pregnancy. If this is not appropriate, it may be possible to modify the examination to minimise the baby's radiation dose.

Clearly, avoidance of radiation exposure is a sensible approach where this does not compromise the health care of the mother or baby.

Are all x-ray examinations of concern?

If the x-ray examination does NOT directly expose the lower abdomen (where the baby might otherwise lie within the main x-ray beam that creates the x-ray image) you can be reassured that the radiation dose will be very low and possibly so low that it would be difficult to measure.

This applies in particular to dental x-rays and x-rays of the extremities. Even a chest x-ray, which exposes the entire lung area, should result in only a very small radiation dose to the baby.

X-ray examinations which may directly expose the baby to the useful x-ray beam include those of the lower abdomen, pelvis, lumbo-sacral spine, sacro-iliac joints, sacrum, coccyx and bowel (by a barium enema).

However, even these examinations may not necessarily expose the baby to radiation doses of concern.

An accepted guideline for a more thorough investigation of the risk is where the radiologist (the doctor responsible for the conduct of the x-ray examination) believes that the baby's dose might have exceeded 20 mGy. In such circumstances the dose should be more accurately assessed and closer consideration of the potential risk to the baby made in consultation with the family doctor or other appropriate medical practitioner.

A dose of this magnitude is rare but may result from some CT (computed tomography) x-ray examinations involving the lower abdomen or pelvis and from extensive or prolonged fluoroscopic x-ray examinations of that region.

Diagnostic Nuclear Medicine Investigations

Diagnostic nuclear medicine investigations have some similarities to diagnostic x-ray examinations. With x-rays, radiation emitted by an electrically energised x-ray tube passes through the patient where the x-rays strike some form of image receptor, usually x-ray film.

With nuclear medicine, the patient inhales, ingests or is injected with a small quantity of a radioactive isotope which is bound in a substance which targets a particular organ e.g. the liver, thyroid, bone, heart, etc.

The gamma radiation emitted by the radioactive isotope is detected outside the body by the electronic receptors of a gamma camera which displays images or functional data about the organ of interest.

Depending on the procedure, the mother and baby will receive a small radiation dose. It is unlikely, however, that any diagnostic nuclear

medicine investigation would result in the baby's radiation dose approaching 20mGy.

The same principles of avoidance of radiation exposure apply as with the use of x-rays. (Read the section on *Postponing or modifying the x-ray examination*).

What to do after a 'high' dose x-ray examination or nuclear medicine procedure

Don't be overly concerned. Even at the guideline dose of 20 mGy the assumed risks are not great (see appendix for table).

Talk to your doctor about obtaining an estimate of the likely radiation dose from the radiologist or nuclear medicine specialist responsible for performing the procedure.

If it is confirmed that there is the possibility that the baby's radiation dose could be close to or exceed 20 mGy, your doctor and the radiologist or nuclear medicine specialist should arrange for a more accurate dose assessment.

Occupational Radiation Exposure

Pregnancy should not prevent women working with ionising radiation provided safe work practices, which are applicable to the type of radiation work being carried out, are followed. However, special dose limits are imposed for pregnant radiation workers under the Regulations to the Radiation Safety Act (Radiation Safety (General) Regulations 1983).

As soon as a radiation worker becomes pregnant, the radiation dose to the surface of her abdomen from external radiation sources at work, is recommended not to exceed 2 mGy for the remainder of the pregnancy.

The employer must take steps to ensure that this limit is not exceeded.

This dose limit is intended to restrict the baby's radiation dose to the same limits that apply to the general public - i.e. 1/20th of the occupational exposure limit. For persons working with unsealed radioactive substances, restrictions on inhalation, ingestion or absorption are also intended to provide the same level of protection to the baby.

When working with any potentially hazardous radiation source it is a sensible precaution to apply the ALARA principle by keeping all exposures as low as reasonably achievable.

Further information

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This document can be made available in alternative formats on request for a person with a disability.

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Appendix

		Risk of the possible effect for acute doses of:		
Time after conception	**Possible Effect**	**1 mGy**	**10 mGy**	**500 mGy**
0 - 4 weeks	Abortion	Nil	Nil	Possible
8 - 15 weeks	Mental retardation	Nil	Nil	20%
	IQ score decline			15 points
4 - 18 weeks	Reduced head size	Nil	Nil	30%
16 - 25 weeks	Mental retardation	Nil	Nil	5%
	IQ score decline	Nil	Nil	4 points
Throughout pregnancy	Childhood cancer	0.002%	0.02%	1%
	Fatal adult cancer	0.006%	0.06%	3%

[1] Radiation Protection Notes and News (NZ National Radiation Laboratory) No 14 April 1993