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Advice on Radiological Examination
for Women of Childbearing Age

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A. Purpose: Radiation Risk to Fetus

The Radiation dose to the embryo or fetus that is likely to result from any radiological procedure in current use should present negligible risk of causing fetal death, malformation, growth retardation or impairment of mental development but may still involve a small risk of childhood cancer induction.

For the majority of radiological medical procedures, giving fetal doses up to a milligray (mGy), the associated risks of childhood cancer are very low (below 1 in 10000) and judged to be acceptable when compared with the natural risk (around 1 in 500). Consequently, all such examinations can be carried out on pregnant women, as long as they have been clinically justified and the dose is kept to a minimum consistent with the diagnostic requirements.

Exposure of pregnant women to procedures leading to fetal doses in excess of a few mGy, and – at the highest doses – may result in a doubling of the childhood cancer risk compared to the natural rate. Consequently, such examinations should be avoided on pregnant women, unless the health of the mother (and indirectly that of the unborn child) would be compromised by delaying the examination until after the baby has been born. However, if such examinations are considered to be clinically justified or are carried out inadvertently, the childhood cancer risk associated with them is still low in absolute terms (below 1 in 200 and mostly below 1 in 1000) and termination of the pregnancy would not be justified solely on the basis of the radiation risk to the unborn child.

For most diagnostic radiation exposures of women in the first 3 to 4 weeks post-conception when the pregnancy is unrecognized, the risks of childhood cancer will be very small (and probably much smaller than if the exposure had occurred later in pregnancy). **However, those few examinations yielding fetal doses in excess of about 10 mGy could involve levels of risk that should be avoided, if possible, even in unrecognized pregnancies.**

B. High Fetal Dose Radiological Procedures

According to Table 1, the following examinations are defined as high fetal dose (> 10 mGy) radiological procedures.

- Any CT including Pelvis (e.g. CT Pelvis, CT Urogram)
- ^{99m}Tc Myocardial (SPECT rest-exercise protocol)
- ¹⁸F PET/CT/MR Whole Body Scan

Table 1. Typical fetal doses and risks of childhood cancer for some common diagnostic medical exposures.

Examination		Typical fetal dose range (mGy)*	Risk of childhood cancer per examination
X-ray	Skull	0.001 – 0.01	< 1 in 1,000,000
X-ray	Teeth		
X-ray	Chest		
X-ray	Thoracic spine		
X-ray	Breast (mammography)		
X-ray CT	Hand and/or neck		
⁵¹ Cr	GFR measurement		
^{81m} Kr	Lung ventilation scan		
X-ray CT	Pulmonary angiogram	0.01 – 0.1	1 in 1,000,000 to 1 in 100,000
^{99m} Tc	Lung ventilation scan (Technegas)		
X-ray	Abdomen	0.1 – 1.0	1 in 100,000 to 1 in 10,000
X-ray	Barium meal		
X-ray	Pelvis		
X-ray	Hip		
X-ray CT	Pelvimetry		
X-ray CT	Chest and liver		
^{99m} Tc	Lung perfusion scan		
^{99m} Tc	Thyroid scan		
^{99m} Tc	Lung ventilation scan (DTPA)		
^{99m} Tc	Renal scan (MAG3, DMSA)		
^{99m} Tc	White cell scan		
X-ray	Barium enema	1.0 – 10	1 in 10,000 to 1 in 1,000
X-ray	Intravenous urography		
X-ray	Lumber spine		
X-ray CT	Lumber spine		
X-ray CT	Abdomen		
^{99m} Tc	Bone scan		
^{99m} Tc	Cardiac blood pool scan		
^{99m} Tc	Myocardial scan		
^{99m} Tc	Cerebral blood flow scan (Exametazine)		
^{99m} Tc	Renal scan (DTPA)		
²⁰¹ Tl	Myocardial scan		
¹⁸ F PET	Tumour scan		
X-ray CT	Pelvis	10 – 50	1 in 1,000 to 1 in 200 <i>Natural childhood cancer risk ~ 1 in 500</i>
X-ray CT	Pelvis and abdomen		
X-ray CT	Pelvis, abdomen and chest		
^{99m} Tc	Myocardial (SPECT rest-exercise protocol)		
¹⁸ F PET/CT	Whole body scan		

*Fetal doses derived from doses to the uterus seen in recent UK surveys^{5,6} and the ARSAC Notes for Guidance⁷ so only apply to early stages of pregnancy while the fetus is small.
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C. Practical Implementation & Guidelines

1. All female patients of childbearing age (within the age range 12-55 years) should be asked for the date of last menstrual period (LMP), if it is not indicated in the request form. When the patient states that there is no possibility of pregnancy (e.g. sexually inactive), this should be recorded on the informed consent and the examination could proceed.
2. There are 2 rules to be observed for females of childbearing age whose pregnancy cannot be excluded:
 - a. **28-day-rule** (Table 2): If she is not sure about her possibility of pregnancy or pregnancy could not be excluded, she should be asked whether her menstrual period is overdue. If it is overdue, then observe the 28-day-rule for normal radiological examinations.
 - b. **10-day-rule** (Table 3): If she is not sure about her possibility of pregnancy or pregnancy could not be excluded, she should be asked whether her menstrual period is overdue. If it is not overdue and the date of LMP is within 28 days, then proceed with the examination **except for high fetal dose procedures** which are likely to deliver a dose of tens of milligray to the conceptus (Table 1), in which case the examination may be postponed to the early part of the menstrual cycle – the “10-day-rule”.

Table 2. 28-day-rule* for Low Fetal Dose Procedures

Day 1 – Day 28 after commencement of menstruation	It is safe to carry out radiological examinations.
Day 29 and onwards	Only urgent radiological examinations to be performed when benefits are likely to far outweigh any small risk from the irradiation.

*28-day-rule, i.e. the examination should be done within day 1 and day 28 of the menstrual cycle.

Table 3. 10-day-rule^ for High Fetal Dose Procedures

Day 1 – Day 10 after commencement of menstruation	It is safe to carry out radiological examinations.
Day 11 and onwards	Only urgent radiological examinations to be performed when benefits are likely to far outweigh any small risk from the irradiation.

^10-day-rule, i.e. postpone the examination to within day 1 and day 10 of the menstrual cycle.

3. If a female patient can confirm that she is pregnant and her menstrual period has been clearly missed (also the 10-day-rule & 28-day-rule cannot apply), then any decision to proceed with the examination should be taken by the referring physician in its clinical necessity (e.g. urgent x-ray examinations when benefits are likely to far outweigh any small risk from the irradiation).
4. Attention should be paid to ensure minimization of exposure to any embryo or fetus that may be present, whether or not the woman is known to be pregnant.

D. Reference

1. IAEA (Currently on the Internet),
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