

Imaging Examinations during Pregnancy

General Considerations

1. All diagnostic exams using radiation require an assessment of the balance between the risk and benefit.
 - a. Seek alternatives to ionizing radiation, if possible and appropriate (i.e., ultrasound, MRI)
 - b. Risk versus benefits of the study to should always be discussed with the patient & referring clinician. Patient should be involved in the discussion to proceed
2. It is the role of the radiologist to counsel the pregnant patient on the effects of ionizing radiation to the fetus & to advise the ordering practitioner about alternative imaging modalities.
 - a. For exams with high fetal exposure (CT Abdomen/pelvis), clinician should document in the chart that in their opinion, the benefit outweighs the risk.
3. If the mother's life is at risk and clear indications for the study exist, the exam should not be delayed or denied because of the pregnancy. Failure to correctly diagnose medical problems in the mother more often poses greater risk to the fetus than the radiation.
4. Radiation risk varies both based on exposure dose and on gestational age.
5. Insufficient data in humans exists to quantify the harmful effects of radiation to the fetus at doses < 50 mGy^{1,2,3} (For perspective, the estimated fetal dose for CT of the abd/pelvis using 4 slice MDCT, 300mAs, 4.5 pitch= 35 mGy)

Radiation Risk/Exposure

Radiation Risk/gestational age

0-2 weeks: ⁹ Potential risk is induced termination, but doses delivered from diagnostic procedures (<50 mGy) have not been associated with such an effect^{1,2,3}. If conceptus survives, it is thought to develop fully with no radiation damage³

2-8 weeks: ⁹ Organogenesis – period of MOST susceptibility, but increased risk when doses >100 mGy (malformations and MR)

Potential Developmental Radiation Effects on Fetus by Gestational Age and Radiation Exposure* ^{10,11}			
Gestational Age (wk)	< 50 mGy	50-100 mGy	>100mGy
0-2	None	None	None
3-4	None	Probably none	Possible spontaneous abortion
5-10	None	Uncertain but likely too subtle to detect	Possible malformations which increase with dose
11-17	None	Uncertain but likely too subtle to detect	Possible IQ deficits/MR which increases with dose
18-27	None	None	IQ deficits not detectable at diagnostic doses
>27	None	None	None applicable to diagnostic medicine

*Adopted from Wiesler, et al. and ACR-SPC practice guidelines

Potential Carcinogenic Effects of Prenatal Radiation Exposure ^{5,6,7}		
Radiation Dose (mGy)	Estimated Childhood Cancer Incidence⁶	Estimated Lifetime Cancer Incidence ⁷
Background-no additional radiation exposure	0.3%	38%
0-50	0.3%-1%	38%-40%
50-500	1%-6%	40%-55%
>500	>6%	>55%

***Lifetime cancer risks from prenatal radiation not yet known. Estimates given are for Japanese males exposed at age 10 from models published by the United Nations Scientific Committee on the Effects of Atomic Radiation

- Natural background radiation to fetus over 9 months = 0.5-1 mGy ⁴
- Multiple societies including National Council on Radiation Protection, International Commission on Radiological Protection, American College of Radiology and American College of Obstetrics and Gynecology concur that the risk of abnormalities is negligible at doses to fetus below 50 mGy.
- The likelihood of NOT developing cancer with NO radiation exposure is 99.93%. ⁴
- The likelihood of NOT developing cancer with 50 mGy dose is 99.12%. ⁴

CT Dose Reduction Techniques¹⁰
--Do not use standard protocols— Decrease kVp for small patients Decrease mAs and use automatic tube current modulation Increase pitch to >1 Obtain scout and avoid directly imaging fetus, if possible Limit field of view Avoid multiple phases Use reconstruction algorithms to compensate for low dose image noise Internal barium shielding (30% oral barium solution)

Intravenous Contrast Agents¹⁵

Iodinated Contrast (CT/diagnostic imaging)

- Has been shown to cross placenta
- Animal tests - no evidence of mutagenic or teratogenic effects, but no controlled human studies have been completed to date
- Rare reports of hypothyroidism, but historical given the type of contrast
- No documented case of fetal hypothyroidism related to contrast.

What About Breast Feeding?

- Available data suggest that it is safe for the mother and infant to continue breast-feeding after receiving iodinated contrast agents
- If there is concern, patient may abstain from breast-feeding for 12-24 hours

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