

What are the risks to the fetus associated with diagnostic radiation exposure during pregnancy?

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EVIDENCE-BASED ANSWER

There is no evidence of significant risk to the developing fetus from any single diagnostic x-ray exposure (strength of recommendation: **C**, based on non-homogenous case-control studies). No studies were found on fetal exposure risks from other

forms of diagnostic radiation such as computed tomography (CT) scans, fluoroscopy, or mammography. Prudent clinicians should order only those studies that result in clinically important information and efforts should be made to minimize fetal exposure.

CLINICAL COMMENTARY

Communication with the patient can go a long way to alleviate concerns regarding effects of radiation

The lack of high-quality research coupled with a general societal fear of radiation during pregnancy can create tension between the physician and the patient who needs diagnostic studies during pregnancy. This review reassures the conscientious practitioner that there is little to fear from the prudent use of routine studies. There is less clarity when a woman needs multiple or higher-dose radiation studies, especially in the first trimester.

Patients need our best estimates regarding the medical necessity, diagnostic

benefit, and overall risk in these situations. Open communication with the patient can go a long way to alleviate concerns regarding the possible teratogenic or carcinogenic effects of radiation. Working more closely with our radiology colleagues to determine the best set of studies for a particular situation can help reduce the overall total radiation exposure. I refer patients who are Internet-savvy to www.familydoctor.org for more information about diagnostic radiation exposure in pregnancy.

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Evidence summary

Clinicians have been concerned about x-ray exposure during pregnancy since the 1950s. Much of this concern was based on the Oxford Survey of Childhood Leukemia, as well as other early case-control studies.¹⁻³ These studies reported an approximate 40% increase in the risk

of childhood leukemia among offspring of women who received diagnostic x-rays in pregnancy. However, by modern standards, these studies are of poor quality as they are limited by reliance on maternal recall of prenatal x-ray exposure, lack of consideration for multiple confounding factors, lack of blinding in determination

TABLE

Risk of childhood malignancy after in utero diagnostic X-ray studies¹

OUTCOME	TYPE OF STUDY	ODDS RATIO [95% CI]
Leukemia ⁹⁻¹⁴	Any x-ray	0.8-1.8 [0.5-3.6]
	Pelvic x-ray	0.7-3.4 [0.4-12.9]
CNS tumor ^{12,15}	Any x-ray	0.78 [0.44-1.36]
	Abdominal x-ray	1.5 [0.5-4.2]
Any cancer ^{12,13,16,17}	Any x-ray	0.92-1.2 [0.47-2.4]
	Abdominal x-ray	1.4 [0.8-2.5]

of exposure and outcome status, limitations in selection of both cases and controls, and other significant methodological flaws.

Modern, well-designed studies have failed to replicate the association between in utero radiation and childhood malignancies found in the early studies. We found 1 good-quality and 5 fair-quality case-control studies examining the association between in utero x-ray exposure and childhood leukemia, as well as 6 fair-quality case-control studies examining the association with other childhood malignancies. These studies found no significant association between in utero exposure to any x-ray in general, or to abdominal or pelvic x-rays and development of subsequent childhood leukemia, central nervous system tumors or other malignancies (TABLE).

No meta-analyses, randomized controlled trials, cohort studies or good- or fair-quality case-control studies were found examining in utero x-rays and decreased head circumference, congenital malformations, spontaneous abortion, low birth weight, or developmental problems. One recent, fair-quality case-control study found an association between prenatal dental x-rays and low birth weight (odds ratio [OR]=1.8 [95% confidence interval, 1.09-1.36]) for radiation exposures above 0.4 Gy.⁴ However, this study has been criticized for several reasons, including lack of

biological plausibility and failure to control for dental disease.⁵

There does not appear to be an increased risk of adverse pregnancy outcomes with prenatal endoscopic retrograde cholangiopancreatogram (ERCP), though this conclusion is based on 2 incomplete case series reports with no follow-up of the infants after delivery.^{6,7} No good- or fair-quality studies were found examining the association between other diagnostic radiation exposures (CT scan, mammography, positron emission tomography scan, dual-energy x-ray absorptiometry [DEXA]) with adverse pregnancy outcomes.

Recommendations from others

The American College of Obstetricians and Gynecologists recommends that women be counseled that x-ray exposure from a single diagnostic procedure does not result in harmful fetal effects. Concern about possible effects of ionizing radiation exposure should not prevent medically indicated diagnostic x-ray procedures from being performed on a pregnant woman.⁸

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CONTINUED ON PAGE 444

FAST TRACK

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