

MOTHERISK ROUNDS

Diagnostic Radiation in Pregnancy: Perception Versus True Risks

Raanan Cohen-Kerem, MD,¹ Irena Nulman, MD,¹ Maria Abramow-Newerly, BSc,¹ Damien Medina, BSc,¹ Ronnen Maze¹, BSc, Robert L. Brent, MD, PhD,² Gideon Koren, MD¹

¹Motherisk Program, Division of Clinical Pharmacology and Toxicology, Department of Pediatrics, the Hospital for Sick Children, Toronto ON

²Department of Pediatrics, Jefferson Medical College, Philadelphia PA, and DuPont Hospital for Children, Wilmington DE

Abstract

Significant numbers of therapeutic abortions are performed for radiation-exposed pregnant women because of concerns about the teratogenic risk. However, available data suggest that current diagnostic radiation procedures are not teratogenic.

Résumé

Un nombre imposant d'avortements thérapeutiques sont pratiqués chez des femmes enceintes soumises à une radiothérapie en raison du risque de tératogénicité. Toutefois, les données disponibles suggèrent que les procédures diagnostiques courantes en matière de radiothérapie ne sont pas tératogéniques.

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CASE PRESENTATION

The following is not a single case counselled by Motherisk, but a composite that illustrates a typical presentation.

A 26-year-old woman, unaware of her pregnancy of seven weeks' gestation, had an upper gastrointestinal (GI) X-ray series to investigate epigastric pain. She had been on an oral contraceptive for more than two years. After pregnancy was diagnosed, she was told by the radiologist she should terminate the pregnancy because of a high likelihood of malformations. The obstetrician who was asked to perform the pregnancy termination indicated to the patient that this diagnostic procedure does not appear to cause malformations. Unconvinced, she asked to go ahead with the termination but agreed to be counselled by Motherisk. Motherisk calculated that the average fetal radiation exposure could be

up to 1.1 mGy.¹ The radiologist in this case estimated it to be 0.9 mGy (1 Gy = 100 rads).

DISCUSSION

It has been estimated that approximately 30 000 fertile women were exposed to an abdominal radiographic diagnostic procedure during the 1980s in the United States.² The Health Physics Society's website, Ask the Expert (ATE) receives 600 to 700 consultations each year concerning radiation exposure during pregnancy, obviously only a small sample of the number of occurrences. Newer radiological techniques such as computerized tomography (CT) and therapeutic uses of radiation and radionuclides can expose the fetus to greater than 50 mGy. Handbook 54 of the National Council on Radiation Protection (NCRP) established the 50 mGy level in 1977 for two reasons: first, that most diagnostic radiological procedures do not exceed 50 mGy, and second, that the threshold for birth defects during the most sensitive period of embryonic development is > 200 mGy.^{3,4} Furthermore, protraction and fractionation of radiation decreases the radiation's teratogenic potential,^{5,6} so that lengthy procedures, multiple procedures separated by hours or days, or use of radionuclides have a lower reproductive risk than an acute exposure.⁴

The Motherisk Study

A cohort of pregnant Canadian women who contacted the Motherisk program between 1999 and 2002 inquiring about exposure to a radiographic diagnostic procedure underwent prospective follow-up.⁷ They were exposed to various radiographic diagnostic procedures that involved ionizing radiation. Excluded from the study were women exposed to radiation therapy for conditions such as cancer or for

Key Words: Pregnancy outcome, ionizing radiation, imaging, induced abortion, abnormalities

Table 1. Average fetal dose from X-ray procedures (from Health Canada)¹

Diagnostic study type	Average dose (mGy)	Diagnostic study type	Average dose (mGy)
Dental	< 0.01*	Barium meal (upper GI fluoroscopy)	1.1
Chest	< 0.01	Barium enema (fluoroscopy)	6.8
Mammography	< 0.05*	Head CT	< 0.005
Pelvis	1.1	Chest CT	0.06
Abdomen	1.4	Lumbar spine CT	2.4
Lumbar spine	1.7	Abdominal CT	8.0
Natural background radiation (entire pregnancy)	0.5*	Pelvis CT	25

*Estimates made by Health Canada.

CT: Computerized tomography.

Table 2. Characteristics of pregnant women who were exposed to a radiographic diagnostic procedure and their controls

Variable	Radiation (n = 198)	Control (n = 198)	P
Mean maternal age (years) ± SD	32.1 ± 5.2	32.0 ± 4.8	0.81
Gravidity (mean ± SD)	2.57 ± 1.7	2.36 ± 1.8	0.72
Parity (mean ± SD)	1.97 ± 1.3	1.96 ± 0.8	0.35
Weight gain (mean ± SD)	14.71 ± 8.6	15.26 ± 9.8	0.64
Delivery method			
Vaginal	125 (71.8%)	134 (69.8%)	0.75
Caesarean section	33 (19%)	33 (17.2%)	0.76
Vaginal w/assist	16 (9.2%)	25 (13%)	0.32

SD: Standard deviation.

thyroid ablation therapy, as well as women simultaneously exposed to known teratogenics (e.g., anticonvulsants, heavy use of alcohol or tobacco, or retinoids).

The primary outcome measure of the study was the frequency of major birth defects, defined as structural abnormalities requiring surgical or cosmetic correction or functional abnormalities with major impact on a child's life quality.⁸ Details of radiation exposure included the type, location, gestational age at the time of the procedure, indication, number of sessions, and the use of protective shielding.

Data on radiation dose were taken from Health Canada guidelines¹ where average values of fetal dose are presented for different types of procedures (Table 1). Each value assumes the actual amount of radiation, taking into account an average number of exposures.

Data from a control group were retrieved from the Motherisk database and compared with data from the selected cohort. The women in the control group were not

exposed to a radiographic diagnostic procedure, cancer therapy, thyroid ablation, or any other teratogen during pregnancy and were queried by Motherisk on exposure to non-teratogenic medications. This group of women was matched with the radiation-exposed group for maternal age, gravidity, and parity.

Characteristics of pregnant women who were exposed to a radiographic diagnostic procedure and of their controls are shown in Table 2. We completed follow-up on 198 women who were exposed to radiographic diagnostic procedures in their pregnancy. Most (77.2%) of the diagnostic imaging procedures were performed in the first trimester of pregnancy.

Radiation data

The fetal dose (average ± standard deviation) following exposure to a radiographic diagnostic procedure was 2.3 ± 0.59 mGy (range 0.01–68.0 mGy). The average gestational age of exposure was 9.1 ± 0.7 weeks (range 1–38 weeks). The average number of views per pregnancy was 2.7 ± 0.2

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