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SUBJECT: DIAGNOSTIC IMAGING OF PREGNANT PATIENTS	Effective: 1978 Reviewed: 05/2019
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DIAGNOSTIC IMAGING OF PREGNANT PATIENTS

Purpose:

Imaging of pregnant patients demands extreme caution as both the mother and fetus are at greater risk of radiation induced injury. The intention of this policy is to provide guidance to ensure that the ionizing radiation exposure to the mother's torso and subsequently the fetus is limited.

Radiation Dose Units

- 1 rad = 1 rem
- 1 rad = 10mGy


Background:

Available scientific data shows that the health risks associated with radiation exposure to the fetus are small for the dose levels delivered in most diagnostic procedures. Data suggests that the risk of radiation induced congenital defects is at the level of 0.5 to 1% per rem (1-4). There are no proven effects for total radiation doses to the fetus less than 5 rem or 50 mGy (5-6). The American College of Radiology cites the risk to the fetus at radiation levels less than 100 mGy as, "...scientifically uncertain and probably too subtle to be clinically detectable" (7). The radiation dose to the fetus from diagnostic procedures when the fetus is not in the x-ray beam is approximately the same as daily background radiation dose received by the average American (approximately 0.3rem/year)


Diagnostic, CT or Interventional studies that place the fetus in the x-ray beam result in substantially higher doses (see Appendix A). It is also important to recognize that health risks to the fetus associated with radiation are cumulative. Therefore, the physician must consider all exposures to radiation before consideration of initiating additional procedures. The guiding principles for using ionizing radiation in exams of the abdomen or pelvis with a pregnant patient are:

1. Any life-saving emergency should be done without delay regardless of pregnancy.
2. For patients known to be pregnant, consideration must be given to alternate methods of imaging that do not use ionizing radiation.
3. If an alternative imaging method is not possible, consider modifying the exam to use less radiation but without compromising the diagnostic adequacy and creating the need for a repeat study.
4. The patient must receive verbal counseling about the need for the exam. The patient should be educated as to the benefit-risk assessment and that in the best medical judgment of the physicians the medical benefits of the exam outweigh any potential risks to the child. See Appendix B for a list of suspected radiation induced effects and associated doses.

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1. Imaging exams that are scheduled or ordered through EPIC on female patients of childbearing age require that the pregnancy status and last menstrual period be entered.
 2. Before an imaging or interventional procedure, the radiology technologist will inquire from all female patients of childbearing age if they are pregnant or if there is a possibility they are pregnant. If the patient is unsure or does not recall their last menstrual period a pregnancy test will be performed.
 3. If a patient is pregnant, the specific situation will determine the appropriate course of action.
 - a. If the exam is to be above the abdomen or below the hips, the technologist is to notify and obtain permission from the radiologist. The technologist is to notify the section manager so a formal calculation will be conducted by a medical physicist.
 - b. If an exam places the fetus in the x-ray beam the technologist will contact the radiologist for guidance before proceeding with the exam.
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1. If the fetus is to be in the direct x-ray beam and the estimated dose is less than 100mGy, the radiologist and ordering physician should work to find options to obtain the needed diagnostic information without using ionizing radiation. If it is deemed necessary to perform the exam, the patient should be involved in the decision to proceed. The radiologist is to request informed consent be obtained from the patient and also for the ordering physician to discuss with the patient the reason the test and inform the patient of the associated radiation risks and benefits. However, if ordering physician is unable to explain radiation risk to patient, the radiologist may obtain consent. The ordering physician will write a note in EPIC stating that the exam is indicated for the management of the patient. The patient will be required to sign an informed consent form before the exam is performed unless it is deemed the patient is incoherent or unable to sign due to severity of the circumstances.
 2. If the exam is to be performed, the technologist is to notify the section manager so a formal calculation will be conducted by a medical physicist. The patient and/or family will be counseled about the radiation risks to the fetus. The ordering physician and radiologist will record in EPIC/RIS the circumstances and medical justification for the exam. The technologist is to make sure the patient has signed an informed consent form. Section manager may be notified via phone, email, voicemail or in person. When reporting a known pregnancy for dose calculation please include the following:
 - i. Patient's Name
 - ii. MRN#
 - iii. DOB
 - iv. Exam Type
 - v. Accession#

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Technical Requirements:

Radiology technologists will adhere to the following principles when imaging pregnant patients. Any deviations from these guidelines require an order from a staff radiologist.


1. Exposures are limited to those specifically ordered or contained in the ordered protocol.
2. Use precise collimation whenever possible.
3. Fluoroscopy will be limited to short bursts. All procedures are to be timed and the time is to be recorded in RIS along with the kVp and mA.
4. Repeat exposures due to technical errors are not to be performed without approval from the radiologist.
5. For CT exams of the abdomen and pelvis the radiologist will be consulted to provide explicit instructions for the scan protocol in order to minimize dose.

Failure to report imaging of a known pregnant patient to section manager for medical physicist dose calculation will result in the following disciplinary action:

- a. The technologist will receive a formal written reprimand for the first occurrence.
- b. The technologist will be reviewed for possible disciplinary action for the second occurrence within a six-month period
- c. Any other occurrences within that same year will be reviewed by the director and the section manager to determine what type of disciplinary action to request to Human Resources

References:

1. Miller RW, Blot WJ. Small head size after in-utero exposure to atomic radiation. Lancet 1072; 2: 784-7.
2. Miller RW, Mulvihill JJ. Small head size after atomic irradiation. Teratology 1976; 14: 355-7.
3. Otake M, Schull WJ. Radiation related brain damage and growth retardation among the prenatally exposed atomic bomb survivors. Int J Radiation Biology 1998; 74: 159-71.
4. Schull WJ, Otake M. Cognitive function and prenatal exposure to ionizing radiation. Teratology 1999; 59: 222-6.
5. Wagner L Lester, Saldana L. Exposure to the Pregnant Patient to Diagnostic Radiation: a Guide to Medical Management. 2nd ed. 1997, Madison Medical Physics Publishing Corp. 259.
6. Otake M, Schull WJ, Lee S. Threshold for Radiation-related severe mental retardation in prenatally exposed A-bomb survivors: a reanalysis. Int J Radiation Biology 1996; 70:755-63.
7. American College of Radiology Practice Guideline for imaging pregnant or potentially pregnant adolescents and women with ionizing radiation, 2013 (resolution 48).

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Estimated dose for diagnostic imaging procedures:

- ☐ Radiographic exam of the abdomen or pelvis, single view


Patient Thickness (cm)	AP View (mGy)	Lateral View (mGy)
14-15	1.0	0.7
16-19	1.5	1.0
20-23	2.1	1.5
24-26	3.1	2.0
27-30	4.3	3.0
31-34	5.6	4.0

- ☐ Fluoroscopy of the abdomen or pelvis – 7.0 mGy/minute (80kVp and 2mA)

- ☐ CT of the abdomen or pelvis (120 kVp, slice thickness \geq 5mm (multi-slice helical CT)

Technique	Dose (mGy)
300mAs	35
200mAs	23
150mAs	17.5

*Wagner L Lester, Saldana L. Exposure to the Pregnant Patient to Diagnostic Radiation: a Guide to Medical Management. 2nd ed. 1997, Madison Medical Physics Publishing Corp. 259.

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Appendix B*

Summary of Suspected In-Utero induced deterministic radiation effects

Menstrual or Gestational age	Conception age	<50mGy	50-100mGy	>100mGy
0-2 weeks	Prior to conception	None	None	None
3 rd & 4 th weeks	1 st – 2 nd weeks	None	Probably none	Possible spontaneous abortion
5 th – 10 th weeks	3 rd -8 th weeks	None	Potential effects are scientifically uncertain and probably too subtle to be clinically detectable	Possible malformations increasing in likelihood as dose increases.
11 th -17 th weeks	9 th – 15 th weeks	None	Potential effects are scientifically uncertain and probably too subtle to be clinically detectable	Risk of diminished IQ or of mental retardation, increasing in frequency and severity with increasing dose.
18 th – 27 th weeks	16 th -25 th weeks	None	None	IQ defects not detectable at diagnostic doses
>27 weeks	>25 weeks	None	None	None applicable to diagnostic medicine

* Stochastic risks are suspected, but data are not consistent [5]. For exposure to a newborn child, the lifetime attributable risk of developing cancer is estimated to be 0.4% per 10 mGy (1 rad) dose to the baby. The potential risks in-utero for the second and third trimesters and part of the first trimester may be comparable, but the uncertainties in this estimate are considerable.

American College of Radiology Practice Guideline for imaging pregnant or potentially pregnant adolescents and women with ionizing radiation, 2013 (resolution 48).