MEDICAL IMAGING IN PREGNANT, POTENTIALLY PREGNANY & LACTATING PATENTS

PURPOSE

- To ensure female patients who are potentially pregnant are adequately screened prior to undergoing medical imaging that utilizes ionizing radiation.
- To ensure that imaging examinations using ionizing radiation in pregnant patients involve the lowest amount of radiation possible to obtain an examination of diagnostic quality (i.e. dose optimization).

GENERAL COMMENTS

- A potentially pregnant patient is any heterosexual female aged 15-50 years who does not have a history of hysterectomy or tubal ligation or does not have an IUD / contraceptive implant currently in place.
- Medical imaging delivering less than 50 mGy (5 rad) to a pregnant uterus is not expected to have any effects on an embryo/fetus.

Table 1: Bioeffects from Fetal Radiation Dose

Fetal Effect	Period of Highest Risk (weeks)	Fetal Dose Threshold (mGy)
Prenatal death	0–1	50
Growth retardation	1–8	200
Organ malformation	2–8	250
Small head size	2–15	100
Loss of IQ	8–15	100
Intellectual disability	8–15	100
Cancer induction	2 to term	. . .

Sources.—References 1 and 2.

- Most diagnostic imaging examinations deliver less than 20 mGy to the uterus. See tables at the end of this policy for the typical radiation doses for various imaging examinations.
- The use of shielding has been shown to potentially increase internal scatter and likely increases the radiation dose to the fetus. In addition the relative risk to the fetus from radiation exposure is much less than previously thought. The use of protective shielding for the pelvis when it is outside the field of view is not recommended.

WHO DOES NOT NEED TO BE SCREENED FOR POTENTIAL PREGNANCY

- Any female patient who is younger than 15 years of age, older than 50 years of age, has a history of hysterectomy or tubal ligation, has an IUD/contraceptive implant in place or is homosexual does not need to be screened for pregnancy regardless of what examination is being performed.

CT EXAMINATIONS

- A potentially pregnant patient must be screened for pregnancy (via urine pregnancy test or blood HCG level) if she is undergoing a CT examination that images the abdomen, pelvis, lumbar spine, sacrum or hips (any anatomy from the upper abdomen to through the hips).
- Potentially pregnant patients do not need to be screened for pregnancy if they are undergoing CT examinations that only image the head, neck, cervical spine, thoracic spine, chest (including PE CTA) or extremities.
- Written informed consent (MI Form 0623) is required for any CT examination in which a pregnant patient's abdomen, pelvis, lumbar spine, sacrum or hips will be directly exposed to radiation beam. It is the responsibility of the ordering clinician (inpatient/ER examinations), supervising radiologist (outpatient examinations) or interventional radiologist (procedures) to obtain informed consent.
- Any imaging examination/procedure that is critically urgent for patient care can be performed without a pregnancy test and without informed consent at the discretion of the supervising radiologist.
- Dose optimization in pregnant patients:
  - The caudal coverage for CTA PE examinations should end at the lung bases (rather than through both adrenal glands).
  - A low-dose renal stone protocol should be used for stone assessment.
  - Multiphase CT examinations should not be performed without permission from the supervising radiologist.
  - Repeated CT examinations over the course of a single pregnancy should not be performed without permission from the supervising radiologist.

XRAY EXAMINATIONS

- Potentially pregnant patients do not need to be screened for pregnancy for any xray examination regardless of what anatomy is being imaged.
- Written informed consent (MI Form 0623) is required for any xray examination in which a pregnant patient's abdomen, pelvis, lumbar spine, sacrum or hips will be directly exposed to radiation beam. It is the responsibility of the ordering clinician (inpatient/ER examinations), supervising radiologist (outpatient examinations) or interventional radiologist (procedures) to obtain informed consent.
- Any imaging examination that is critically urgent for patient care can be performed without a pregnancy test and without informed consent at the discretion of the supervising radiologist.
- Dose optimization in pregnant patients:
  - Obtaining only a frontal chest view in third-trimester patients (eliminating the lateral view).
  - Obtaining only a single abdomen view and a single pelvis view for abdomen series / KUB examinations.

- Obtaining only a single lateral coned in frontal view and a single lateral view for lumbar spine examinations (eliminating non coned in frontal, coned in lumbosacral, oblique and flexion/extension views).
- Obtaining only a single hip/femur view and a frog leg view for pelvis/hips examinations (eliminating frontal view of the whole pelvis).

FLUOROSCOPY EXAMINATIONS

- A potentially pregnant patient must be screened for pregnancy (via urine pregnancy test or blood HCG level) if she is undergoing fluoroscopic imaging or procedure that includes the abdomen, pelvis, lumbar spine, sacrum or hips (any anatomy from the upper abdomen through the hips).
- All potentially pregnant patients undergoing hysterosalpingography (HSG) must be screened for pregnancy (via urine pregnancy test or blood HCG level).
- Written informed consent (MI Form 0623) is required for any fluoroscopic imaging or procedure in which a pregnant patient's abdomen, pelvis, lumbar spine, sacrum or hips will be directly exposed to radiation beam and for all patients undergoing HSGs. It is the responsibility of the ordering clinician (inpatient/ER examinations), supervising radiologist (outpatient examinations) or interventional radiologist (procedures) to obtain informed consent.
- Any imaging examination/procedure that is critically urgent for patient care can be performed without a pregnancy test and without informed consent at the discretion of the supervising radiologist.
- Dose optimization in pregnant patients:
  - Fluoroscopic examinations/procedures should utilize a lower frame rate.
  - Limiting the number of projections obtained during fluoroscopic examinations.

NUCLEAR MEDICINE EXAMINATIONS

- Potentially pregnant patients undergoing nuclear medicine examinations should be asked if they could be pregnant. In patients who respond they could be pregnant; a urine pregnancy test or blood HCG level should be obtained.
- Urine pregnancy tests or blood HCG levels are not routinely required in potentially pregnant patients undergoing nuclear medicine examinations unless they state there is a possibility of pregnancy.
- All potentially pregnant patients undergoing I-131 imaging or treatment require a urine pregnancy test or a blood HCG level prior to the examination.
- Written informed consent (MI Form 0623) is required for nuclear medicine examinations in pregnant patients (except for lymphoscintigraphy and dacroscintigraphy). It is the responsibility of the ordering clinician (inpatient/ER examinations), supervising radiologist (outpatient examinations) or interventional radiologist (procedures) to obtain informed consent.

MAMMOGRAPHY / BONE DENSITY EXAMINATIONS

- Potentially pregnant patients undergoing mammographic imaging/procedures or bone density examinations do not require screening for or laboratory testing for pregnancy due to the low doses of radiation involved in these examination.

ULTRASOUND EXAMINATIONS

- The only ultrasound examination in which a urine pregnancy test or HCG blood level is required in a potentially pregnant patient is saline-infused sonohysterography (SIS).

CT CONTRAST IN PREGNANT PATIENTS

- Iodinated IV contrast is FDA category B – No adverse effects in animal reproductive studies, but there are no controlled studies in pregnant women. Newborns should be tested for hypothyroidism during the first week of life (already routine practice in North America).
- Pregnant patients receive iodinated IV, oral, rectal and bladder contrast according to the same guidelines as for non-pregnant patients.
- Informed consent is not required in pregnant patients who are to receive iodinated contrast.

MRI IV CONTRAST IN PREGNANT PATIENTS

- Gadolinium IV contrast is FDA category C – Animal reproduction studies showed adverse effects to the fetus, but there are no controlled studies in humans. No case reports of adverse fetal effects.
- Potentially pregnant patients undergoing MRI examinations in which IV contrast is to be administered should be asked if they could be pregnant. In patients who respond they could be pregnant; a urine pregnancy test or blood HCG level should be obtained.
- IV gadolinium contrast is only administered to a pregnant patient when deemed essential by the supervising radiologist and with the approval of the patient's OB/GYN.
- Written informed consent (MI Form 0623) is required for patients receiving gadolinium IV contrast. Informed consent can be obtained by the supervising radiologist, the patient's OB/GYN or the clinician ordering the examination. The order for the contrast should be signed back to whomever obtained the informed consent.

CT & MRI IV CONTRAST IN BREASTFEEDING PATIENTS

- It is no longer recommended that breastfeeding patients discard (pump and dump) breast milk for 24 hours after receiving iodinated or gadolinium IV contrast. However, a patient can still pump and dump for 24 hours if she wishes.
- Much less than 1% of the dose of CT or MRI IV contrast administered to the mother is excreted into the breast milk and absorbed by the infant's GI tract. Put another way, the IV contrast dose that would be administered to an infant undergoing CT or MRI would be larger than the dose that would be absorbed through breast milk.

- Examples to ease patient concerns:
  - An infant absorbs less than 0.01% of the dose of iodinated IV contrast administered to the mother (i.e. the mother would have to receive 10 liters (2.6 gallons) of contrast for the infant to absorb 1 mL of contrast).
  - An infant absorbs less than 0.004% of the dose of gadolinium IV contrast administered to the mother (i.e. the mother would have to receive 250 liters (66 gallons) of contrast for the infant to absorb 1 mL of contrast).

NUCLEAR MEDICINE RADIONUCLIDES IN BREASTFEEDING PATIENTS

- See individual nuclear medicine protocols for guidelines for breastfeeding patients.

RADIATION DOSES FOR VARIOUS IMAGING EXAMINATIONS

Table 1: Radiation Doses Associated with Common Radiologic Examinations

Modality	Fetal Dose (mGy)	Maternal Dose (mSv)	Breast Dose (mGy)
CT			
Head or neck	1.0–10	0.9–4.0	…
Pulmonary angiography	0.01–0.66	2.7–40	8–70
Abdominal	1.3–35	3.5–25	…
Pelvic	10–50	3.3–10	…
Abdomen and pelvis	13–25	3–45	…
Aortic angiography of chest, abdomen, and pelvis, with or without contrast agent	6.7–56	4–68	16–130
Coronary artery angiography	0.1–3	7–39	10–90
Nonenhanced CT of abdomen and pelvis to evaluate for nephrolithiasis	10–11	3–10	…
Nuclear medicine			
Low-dose perfusion scintigraphy	0.1–0.5	0.6–1.0	0.1–0.3
V/Q scintigraphy	0.1–0.8	1.2–2.8	0.2–0.7
Technetium 99 (^{99m}Tc) bone scintigraphy	10–50	6.7	…
Fluorine 18 (^{18}F)–FDG PET/CT whole-body scintigraphy	9.4–21.9	13.5–31.9	14
^{18}F-FDG PET myocardial viability	6.8–8.1	7	…
Myocardial perfusion with ^{99m}Tc-sestamibi	17	11.4–14.8	…
Myocardial perfusion with ^{99m}Tc-tetrofosmin	8.45	9.3–11.6	…
Radiography			
Mammography, two views	0.001–0.01	0.1–0.7	3
Chest radiography, two views	0.0005–0.01	0.06–0.29	<0.04
Extremity and cervical spine radiography	<0.001	0.03–0.22	…
Abdominal radiography	0.1–0.3	0.01–1.1	…
Lumbar spine radiography	1.0–10	0.5–1.8	…
Other			
Intravenous pyelography	5–10	0.7–3.7	…
Double-contrast barium enema	1.0–20	2.0–18.0	…
Small bowel examination	7	3.0–7.8	…

Source.—References 6–8,10,11,16–21.
Note.—Estimated dose varies according to protocol, radiotracer type and dosage, method of dose calculation, and patient-dependent factors (eg, weight or body habitus and percentage of glandular breast tissue). FDG = fluorodeoxyglucose, PET = positron emission tomography, V/Q = ventilation-perfusion.

REFERENCES

- ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Patients with Ionizing Radiation - https://www.acr.org/-/media/ACR/Files/Practice-Parameters/pregnant-pts.pdf.Duration of Breastfeeding Interruption in Nuclear Medicine Procedures - https://doi.org/10.2967/jnmt.122.264910.
- Fetal Dosimetry at CT: A Primer - https://doi.org/10.1148/rg.2020190166.
- Foetal Radiation Dose and Risk from Diagnostic Radiology Procedures - https://doi.org/10.5402/2013/318425.
- Imaging Pregnant and Lactating Patients - https://doi.org/10.1148/rg.2015150031.
- Imaging in Pregnant patients: Examination Appropriateness - https://doi.org/10.1148/rg.305105034.
- Quality Initiatives: Guidelines for Use of Medical Imaging during Pregnancy and Lactation - https://doi.org/10.1148/rg.323115120.