Protocol for Radiologic Imaging
for Pregnant and Lactating Patients

Preamble[1]

Imaging of pregnant patients demands extreme care as both the mother (maternal breast) and fetus are at greater risk for radiation induced injury. Also, systematically administered agents, such as intravenous iodinated contrast, gadolinium contrast and nuclear agents, are experienced by the fetus. The intention of the UNC Ob-Gyn and Radiology protocol of imaging pregnant and lactating patients is to show the utmost care in limiting exposure of ionizing radiation to the mother's torso and limiting use of intravenous agents and radioactive pharmaceuticals.

The following general guidelines were agreed upon by the Departments of ObGyn/MFM and Radiology.

1) Radiation exposure should be judiciously used and kept to a minimum.
2) Females of child-bearing age will be asked if they may be pregnancy prior to imaging of the torso or for higher radiation dose procedures. If the patient answers yes and a pregnancy test is necessary or requested, her urine or serum will be collected and tested for pregnancy. If performed, the pregnancy test will be documented by the technologist.
3) Prior to ordering any radiology study, an ObGyn/MFM fellow/attending must assess a pregnant patient and document in the medical record the indication for the study and confirm that the potential risks to the fetus were discussed with the patient. Exceptions to this include any study involving body parts above the diaphragm or below the hips, including extremity films.
4) Informed written consent for radiation/radiofrequency pulse exposure (MRI) and specific imaging study will be obtained by a radiologist at the time of the study. Exceptions as above. Radiation dose will be discussed with the patient and estimated as requested using data provided by a radiation physicist.

Selected Counseling/Management Points[2]:

Risk of teratogenesis and carcinogenesis after diagnostic CT [2,3,4]:

Teratogenesis in the fetus is not a major concern after diagnostic pelvic CT studies. Carcinogenesis in the fetus is key concern after diagnostic pelvic CT studies; hence CT of the fetus should be avoid in all trimester unless maternal benefit outweighs fetal risk.

Lactation after contrast media (iodinated contrast or gadolinium)[2,5]:

May continue breastfeeding without interruption. Women who are concerned about the theoretical risks of contrast exposure may express and discard milk for 24 hours.

Use of Gadolinum [2,5]:

Should be avoided during pregnancy given concern for fetal nephrotoxicity; use only if absolutely essential.

Use of Iodinated Contrast [2,5]:

Use judiciously as concern for neonatal thyroid dysfunction.

Pregnancy termination after diagnostic irradiation [2,5]:

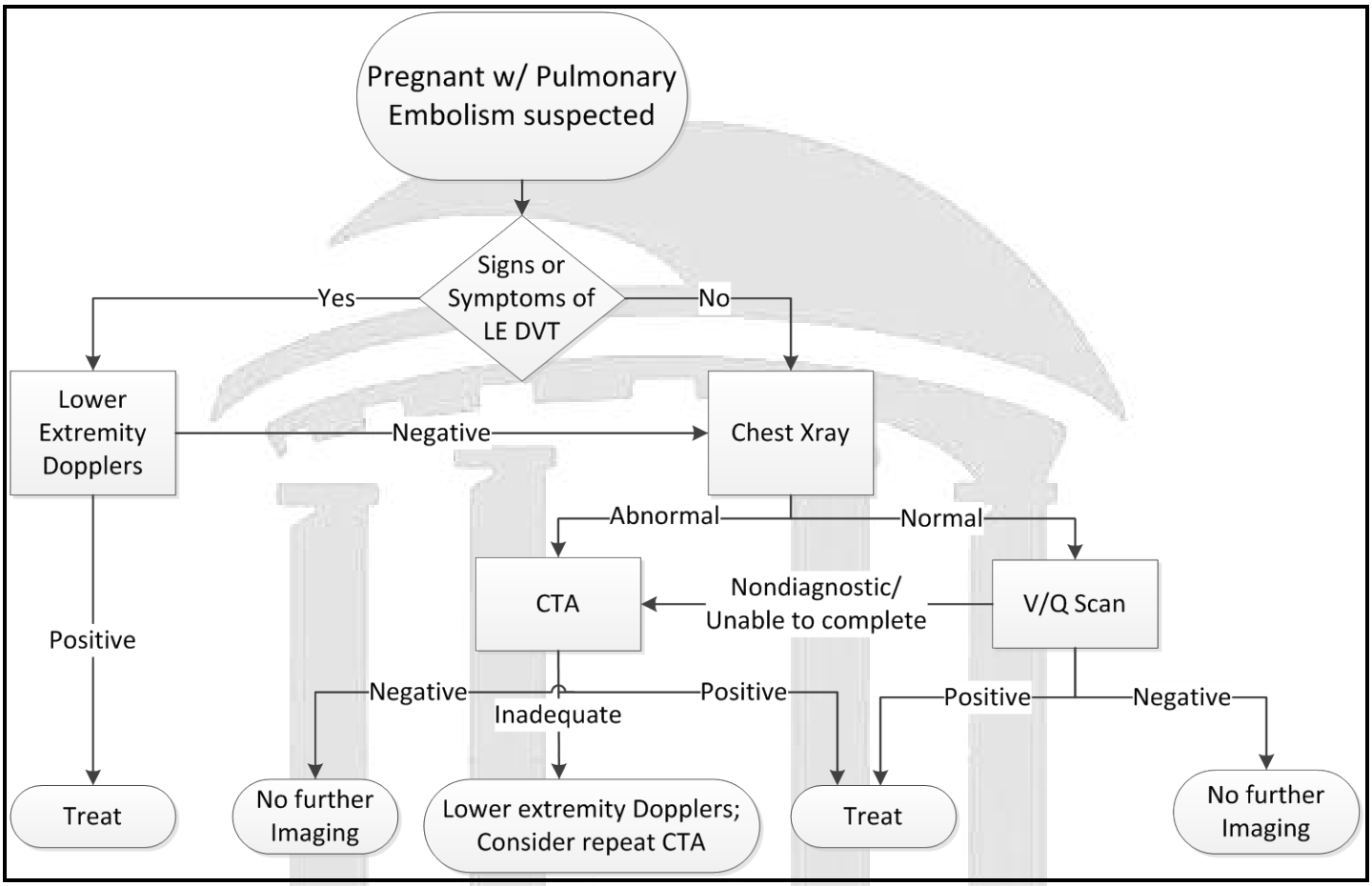
It is exceptionally rare that any single diagnostic radiologic test would deliver a radiation dose sufficient to justify pregnancy termination. Referral to MFM for further discussion if needed. *(The dose of radiation received is listed on all radiologic reports).*

Selected Clinical Situations [2,7]	Suggested imaging modality	Alternative Imaging Modality
Abdominal (Lower) pain		
Appendicitis	MRI Abdomen/Pelvis (pregnancy protocol)	If MRI nondiagnostic and high clinical suspicion, CT Abdomen/Pelvis
Ovarian torsion	Transvaginal and/or abdominal ultrasound	
Urinary calculi	Renal ultrasound	If ultrasound negative: <24weeks – IVP*; >24weeks - Helical CT (renal colic protocol)
Abdominal (Upper) pain		
Cholecystitis or pancreatitis	Right upper quadrant ultrasound	If ultrasound negative and high clinical suspicion, MRCP
Cancer staging		
Abdomen and pelvis	MRI	
Chest	Chest CT with appropriate protocol	
Musculoskeletal/Neurological		
Outside of abdomen/pelvis	Per routine	
Involving abdomen/pelvis	Ultrasound, X-rays, or MRI	
Placenta Accreta	Obstetric ultrasound	MRI without gadolinium (may consider gadolinium for posterior placentas)
Pulmonary Disease		
Pneumonia or Tuberculosis	PA plain film of chest	
Trauma	CT (as per trauma protocol)	

Venous Thromboembolism		
DVT	Venous Compression (Doppler) Ultrasound	
Pulmonary Embolism	See Figure 1	

** IVP has less radiation exposure, but visualization is limited with advancing gestational ages.*

Figure 1: Diagnostic Algorithm for Suspected PE in Pregnancy[8]



Tables to assist with counseling[6]

TABLE 2: American College of Radiology Summary of the International Commission on Radiological Protection Suspected In-Utero Induced Deterministic Radiation Effects

Menstrual or Gestational Age	Conception Age	Radiation Dose		
		< 50 mGy (< 5 rad)	50–100 mGy (5–10 rad)	> 100 mGy (> 10 rad)
0–2 wk (0–14 d)	Before conception	None	None	None
3rd and 4th wk (15–28 d)	1st–2nd wk (1–14 d)	None	Probably none	Possible spontaneous abortion
5th–10th wk (29–70 d)	3rd–8th wk (15–56 d)	None	Potential effects are scientifically uncertain and probably too subtle to be clinically detectable	Possible malformations increasing in likelihood as dose increases
11th–17th wk (71–119 d)	9th–15th wk (57–105)	None	Potential effects are scientifically uncertain and probably too subtle to be clinically detectable	Increased risk of deficits in intelligence quotient or mental retardation that increase in frequency and severity with increasing dose
18th–27th wk (120–189 d)	16th–25th wk (106–175 d)	None	None	Intelligence quotient deficits not detectable at diagnostic doses
> 27 wk (> 189 d)	> 25 wk (> 175 d)	None	None	None applicable to diagnostic medicine

TABLE 3: Estimated Conceptus Doses from Radiographic and Fluoroscopic Examinations

Examination	Typical Conceptus Dose (mGy)
Cervical spine (anteroposterior, lateral)	< 0.001
Extremities	< 0.001
Chest (posteroanterior, lateral)	0.002
Thoracic spine (anteroposterior, lateral)	0.003
Abdomen (anteroposterior)	
21-cm patient thickness	1
33-cm patient thickness	3
Lumbar spine (anteroposterior, lateral)	1
Limited IV pyleogram[a]	6
Small-bowel study[b]	7
Double-contrast barium enema study[c]	7

TABLE 4: Estimated CT Conceptus Doses From Single Acquisition

Examination	Dose Level	Typical Conceptus Dose (mGy)
Extraabdominal		
Head CT	Standard	0
Chest CT	Standard	0
Routine	Standard	0.2
Pulmonary embolus	Standard	0.2
CT angiography of coronary arteries	Standard	0.1
Abdominal		
Abdomen, routine	Standard	4
Abdomen/pelvis, routine	Standard	25
CT angiography of aorta (chest through pelvis)	Standard	34
Abdomen-pelvis, stone protocol[a]	Reduced	10

Resources/References:

UNC Department of Radiology Protocols/Policies: "UNC Pregnancy Policy" and "Breast Feeding following a Contrast-Enhanced CT or MRI" http://www.med.unc.edu/radiology/Dept-info/department-protocols-policies/department-policies

1) American College of Radiology Guideline for imaging pregnant or potentially pregnant adolescents and women with ionizing radiation. Aug 28, 2012. Accessed online 2/22/13.

2) Chen MM, Coakley FV, Kaimal Anjali, Laros RK. Guidelines for Computed Tomography and Magnetic Resonance Imaging Use During Pregnancy and Lactation. Obstet Gyn. Aug 2008; 112(2, pt 1): 333-340.

3) ACOG Committee Opinion: Guidelines for Diagnostic Imaging During Pregnancy, No 299. Obstet Gyn. Sept 2004; 104(3): 647-650.

4) Donnelly EH, Smith JM, Fafan EB, Ozacan I. Prenatal Radiation exposure: Background Material for counseling pregnant patients following exposure to radiation. Disaster Med Public Health Preparedness. 2011;5:62-68.

5) American College of Radiology: ACR Manual on Contrast Media, Version 7, 2010. Accessed on line 8/21/12.

The American College of Radiology notes that less than 0.01 percent of the maternal dose of contrast is present in breast milk, and the Contrast Media Safety Committee of the European Society of Urogenital Radiology concluded that the amount of gadolinium or iodinated contrast media transferred into milk was insufficient to warrant interruption of breastfeeding. Women who are concerned about the theoretical adverse effects of contrast exposure may express and discard milk for 24 hours.

6) Wang PI, Chong ST, Kieler AZ et al. Imaging of Pregnant and Lactating Patients: Part I, Evidence-based Review and Recommendations. AJR: 198, April 2012.

7) Wang PI, Chong ST, Kieler AZ et al. Imaging of Pregnant and Lactating Patients: Part 2, Evidence-based Review and Recommendations. AJR:198, April 2012.

8) American Thoracic Society Documents: An Official American Thoracic Society/Society of Thoracic Radiology Clinical Practice Guideline – Evaluation of Suspected Pulmonary Embolism in Pregnancy. Am J of Resp Crit Care Med. 2011; 184: 1200-08.

Disclaimer

The above policy/protocol represents the efforts of UNC ObGyn/MFM and Radiology to offer diagnostically accurate and safe imaging to pregnant and lactating patients in the UNC Healthcare system. This policy/protocol is not meant to present a document to be employed for medico-legal reasons either in the UNC Healthcare system or other healthcare systems. In all circumstances, sound medical judgment should supersede recommendations set forth in this policy/protocol. This protocol maybe updated at anytime and the most current version of the policy will be posted on the UNC ObGyn (www.mombaby.org) and UNC Radiology (www.med.unc.edu/radiology/about/protocols) websites.