Diagnostic Imaging During Pregnancy

This guideline is intended for application to patients with a known pregnancy. For guidelines regarding determination of pregnancy / pregnancy screening, please refer to the “Pregnancy Assessment” section under “Scope of Assessment by the Medical Staff” in the University Hospitals Policy and Procedure Manual.

Background

• Most diagnostic radiologic procedures are associated with little, if any, known significant fetal risks. According to the American College of Radiology and the American College of Obstetricians and Gynecologists, no single diagnostic X-ray procedure results in radiation exposure to a degree that would threaten the well-being of the developing pre-embryo, embryo, or fetus. Thus, exposure to a single X-ray during pregnancy is not an indication for therapeutic abortion.

• The vast majority of routine diagnostic studies deliver < 20 mGy to the uterus, and single-phase acquisition computed tomography (CT) of the abdomen including pelvis usually delivers < 35 mGy.

• When multiple diagnostic X-rays are anticipated during pregnancy, imaging procedures not associated with ionizing radiation, such as ultrasonography and magnetic resonance imaging, should be considered.
  o It may be helpful to consult an expert in dosimetry calculation to determine estimated fetal dose.

• The use of radioactive isotopes of iodine is contraindicated for therapeutic use during pregnancy. Other radiopaque and paramagnetic contrast agents have not been studied in humans, but animal studies suggest that these agents are unlikely to cause harm to the developing human fetus.
  o Although imaging techniques requiring these agents may be diagnostically beneficial, these techniques should be considered during pregnancy only if potential benefits justify potential risks to the fetus and the patient has given consent.

• Mammography can also be performed safely at any time during pregnancy. Radiation exposure to a conceptus from a properly performed screening mammogram is inconsequential.
  o However, pregnancy may limit the sensitivity of mammography due to increased breast density. Thus, decisions as to whether to proceed with the examination should be based on clinical circumstances.

• Pulmonary embolism (PE) accounts for 20% of maternal deaths in the United States. Accurate clinical diagnosis of venous thromboembolism (VTE) in pregnancy is difficult due to the overlap of signs and symptoms between physiologic changes of pregnancy and development of PE or deep venous thrombosis (DVT).

• Despite the low-quality evidence, the best available evidence suggests that the first radiation-associated study to be pursued, in the setting of acute pulmonary disease in the pregnant patient, is chest radiography. If there is appropriate clinical suspicion for pulmonary thromboembolism, CT pulmonary angiogram (CTPA) is preferred over pulmonary scintigraphy (V-Q scan) throughout pregnancy if chest x-ray is abnormal.

• Clinical diagnosis of the cause of abdominal pain in a pregnant patient is particularly difficult because of multiple factors of gynecologic or obstetric origin related to normal pregnancy.
  o Numerous non-obstetric entities can cause abdominal pain during pregnancy, including appendicitis and processes of gastrointestinal, hepatobiliary, genitourinary, vascular, and gynecologic origin.

• Magnetic resonance (MR) imaging provides cross-sectional imaging without ionizing radiation or evidence of harmful effects to the fetus. MR imaging can safely demonstrate a wide range of pathologic conditions in the abdomen and pelvis. MR imaging can determine the presence or absence of appendicitis without the drawback of exposing pregnant patients to the ionizing radiation of CT. The excellent soft-tissue contrast resolution of MR imaging also can evaluate numerous additional structures within the field of view that may be the source of the patient’s abdominal pain.

• Accurately identifying acute appendicitis in pregnancy can be difficult. Graded compression ultrasound is highly sensitive and specific, although to a lesser degree after a gestational age of 35 weeks due to technical difficulties.
  o This noninvasive procedure should be considered first in working up suspected acute appendicitis, although considerations regarding operator technique, large body habitus, and possible obscuring bowel and gas may not allow for a conclusive preoperative diagnosis.
• These guidelines have been updated to align with the nationally accepted imaging standards outlined by institutions including the American College of Obstetrics and Gynecology and the American College of Radiology.

• The following table lists the biological effects of radiation level on the developing fetus according to:
  o Gestational age.
  o Amount of radiation.

• Once again, the information supporting these effects is limited. The data listed here are the best representation of known radiation effects, as maintained by the above-listed institutions.

### Potential Radiation Effects on the Fetus by Gestational Age and Radiation Exposure*

<table>
<thead>
<tr>
<th>Gestational Age (wk)</th>
<th>Potential Effects by Radiation Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 50 mGy</td>
</tr>
<tr>
<td>0-2</td>
<td>None</td>
</tr>
<tr>
<td>3-4</td>
<td>None</td>
</tr>
<tr>
<td>5-10</td>
<td>None</td>
</tr>
<tr>
<td>11-17</td>
<td>None</td>
</tr>
<tr>
<td>18-27</td>
<td>None</td>
</tr>
<tr>
<td>&gt;27</td>
<td>None</td>
</tr>
</tbody>
</table>

*adapted from (ACR-SPR Radiology, 2014)

### References


• ACR Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation. American College of Radiology, 2008 (Res. 26).

• ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation. American College of Radiology, 2014 (Res. 39).


### Quality Measures

• Percentage of patients who received both CTPE and V/Q scan.

• Proportion of patients who received abdominal CT without getting abdominal ultrasound or abdominal MRI.

### Guideline Authors

• C. Alexander Grieco, MD

• Cynthia Evans, MD

### Guideline Approved


**Disclaimer:** Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.

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**Algorithm 1. Suspected Pulmonary Embolism in Pregnancy**

**Suspected Pulmonary Embolism**

**Leg Symptoms**

- **Present**
  - **CUS**
    - **Positive**
      - **TREAT**
    - **Negative**
      - **CXR**
        - **Abnormal**
          - **TREAT**
        - **Normal**
          - **STOP**
  - **Absent**
    - **CTPA**
      - **Negative**
        - **STOP**
      - **Positive**
        - **TREAT**

**V/Q**

- **Low Probability Scan**
  - **TREAT**
- **High / Intermediate Probability Scan**
  - **Decision to treat based on clinical suspicion**
- **Very Low Probability Scan/Normal Scan**
  - **STOP**

**NOTE:**
- V/Q scans are interpreted based on probability. Results are reported as such, and require correlation with the pre-test probability for application to the specific patient being assessed.
- The goal is to arrive at a diagnosis based on either CT PA or V/Q scan, as per the above algorithm. The decision to pursue a second examination, based on diagnostic uncertainty or issues with study adequacy, should be based on clinical suspicion and direct discussion between the referring service and radiology.
- Due to the urinary excretion of the radiotracer for V/Q scans, ongoing hydration of the patient is recommended. Frequent voiding should be encouraged, with consideration of bladder catheter placement if necessary, to minimize the radiation dose to the fetus from excreted radiotracer in the bladder.

**Algorithm 2. Suspected Pyelonephritis in Pregnancy**

**Suspected Pyelonephritis**

Bacteriuria accompanied by systemic symptoms or signs (e.g., fever, chills, nausea, vomiting, flank pain)

- **Ultrasound**
- **Consult Radiology if further evaluation is clinically necessary**