

Evaluating Acute Abdominal Pain Through Imaging in Early Pregnancy

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The diagnosis and identification of the etiology of lower abdominal or pelvic pain in a pregnant woman can be challenging. Routine blood workup for acute abdomen in pregnant women is challenging due to physiologic alterations induced by normal pregnancy. Additionally, the anatomic location of the different pelvic organs can be altered by the growing uterus. Thus, it has become clear that sophisticated imaging modalities in pregnancy are needed for the diagnosis of acute abdomen, and such imaging modalities should prove to be harmless to the mother and the growing fetus.



Common Causes of Acute Abdominal Pain in Early Pregnancy

Pregnancy is associated with several issues that may present with complaints such as abdominal pain, a fundal height that is greater than gestational age, and exaggeration of the usual symptoms of pregnancy.

The most common presentation of a first-trimester pathology is 1 of 2 types of acute

abdominal pain.

The first type comprises disorders unrelated to pregnancy, including:

- appendicitis
- ureteric stone obstruction
- rupture of an ovarian cyst
- adnexal torsion
- degenerating myoma

The second type comprises disorders related to pregnancy, including:

- placental abruption
- molar pregnancy
- miscarriages

Preexisting diseases that increase the risk and complicate the problems of pregnancy include:

- diabetes
- hypertension

Based on examination findings, the diagnosis and identification of the etiology of lower abdominal or pelvic pain in a pregnant patient can be challenging. The analysis of routine blood workup for these patients is therefore also challenging due to:

- The physiologic alterations induced by normal pregnancy
- The growing uterus, which can alter the anatomic location of the pelvic organs. This makes it difficult to make a conclusive diagnosis based on performed investigations
- The available imaging modalities, such as X-rays, which pose a risk of harm to the patient

In pregnancy, safe and sophisticated imaging modalities are needed for the diagnosis of acute abdominal pain and other first-trimester conditions. These choices include ultrasonography, X-ray, and magnetic resonance imaging (MRI) techniques.

Ultrasonography

Ultrasonography remains the **imaging modality of choice** for the identification of various pathologies and their etiologies in the first trimester of pregnancy.

Ultrasonography is known to be **safe** in early pregnancy and during organogenesis. The sensitivity and specificity of ultrasonography in the evaluation of the maternal pancreas, kidneys, and gallbladder is excellent. During the first trimester, the uterus is not large enough to obscure other pelvic or abdominal organs. Therefore, ultrasound is important for the following:

1. Identification and assessment of causes of abdominal pain that may not be related to pregnancy, such as acute appendicitis. Ultrasonography is commonly used in pregnant women suspected to have appendicitis. Unfortunately, the **visualization of the appendix with ultrasonography can be difficult**. Therefore, the use of ultrasonography for the evaluation of a patient with acute appendicitis is usually indicated for the exclusion of other obstetric or gynecological causes of pelvic pain rather than confirming the diagnosis of appendicitis.
2. Identification and assessment of the causes of abdominal pain that may be related to pregnancy, such as ectopic pregnancy, molar pregnancy, threatened abortion,

and incomplete abortion. During the third trimester, ultrasound is used to assess the position of the placenta, fetal cardiac activity, and breathing movements.

3. Diagnosis and dating of the pregnancy when the last normal menstrual period is uncertain.
4. Assessment of fetal development and identification of early congenital abnormalities. Ultrasonography is also used in early pregnancy for calculation of the gestational age and the confirmation of fetal viability. During the second and third trimesters, ultrasound is used to **exclude congenital anomalies, assess the amniotic fluid volume, assess the placenta, and evaluate the overall well-being of the fetus.**
5. Guiding therapeutic procedures such as chorionic villus sampling, cervical cerclage, and amniocentesis.
6. Determination of multiple gestation, its chorionicity, and amnionicity.

X-Ray

Plain Radiography or Computed Tomography (CT)

Plain radiography or CT may be needed in early pregnancy for the evaluation of certain conditions. With conventional x-ray machines, the **radiation dose from a single exposure is too low to be associated with any fetal anomalies or fetal loss.**

Pelvic Radiography

Pelvic radiography may be used for the **evaluation of urolithiasis** in pregnant women.

Abdominal Radiography

Abdominal radiography may be indicated in pregnant women **suspected to have a small bowel obstruction.** A single x-ray exposure is very unlikely to cause harm to the fetus.

CT Scans

CT scans of the lower abdomen or pelvis may help evaluate certain conditions in pregnancy (eg, acute pancreatitis or appendicitis). While the radiation dose from a single CT scan of the pelvis is about 10 mGy, it should still be **used with caution in pregnant women.** The risk of fetal anomalies or fetal loss after a single pelvic or abdominal CT scan is almost zero; however, there appears to be an **increased risk of childhood cancer** in offspring exposed to ionizing radiation during pregnancy.

Fetal anomalies: Radiation exposure of more than 200 mGy (about 20 pelvic CT scans) during the first 2–8 weeks of gestation is associated with fetal anomalies.

Developmental delays: These are common after exposures that are greater than 500 mGy at 8–12 weeks of gestation and those that are greater than 250 mGy at 16–25 weeks of development.

These numbers clearly demonstrate that a **single CT exposure during early pregnancy will not cause fetal anomalies or loss.** Despite this, ionizing radiation remains a second-line imaging modality in the diagnostic workup of acute abdomen in pregnant patients.

Magnetic Resonance Imaging

The **sensitivity of MRI for acute appendicitis in pregnant women is very high**. MRI is also superior to other imaging modalities in the evaluation of the fetus and for excluding fetal anomalies. MRI during early pregnancy is **likely harmless**; however, contrast agents are rarely administered unless they are necessary to answer the physician's questions. Ultrasonography remains the imaging modality of choice for the diagnostic workup of acute appendicitis in pregnant patients.

Specific Considerations

Acute Appendicitis

Symptoms

Nausea is present in all cases of appendicitis in pregnant women, and **vomiting** is present in two-thirds of women. While **anorexia** is very common in non-pregnant patients with acute appendicitis (80% of cases), it is present less often in pregnant women with acute appendicitis or can easily be written off as a common side effect of pregnancy. **Tenderness** is usually well localized in the right lower quadrant in the first trimester.

White blood cell counts can be as high as 15,000/ μ L in a healthy pregnant woman. Therefore, **white blood cell counts are not useful** in the evaluation of acute appendicitis in pregnant patients.

Diagnosis

Ultrasonography can be used to exclude other causes of pelvic pain such as adnexal torsion, ruptured ovarian cyst, or ruptured ectopic pregnancy. Ultrasonography may also show peri-appendicular edema and fluid collection, findings that are suggestive of acute appendicitis. Patients who are equivocal should undergo either a **CT scan of the pelvis or an MRI study**. Both imaging modalities provide almost 100% sensitivity and specificity for acute appendicitis.

Bowel Obstruction

Abdominal pain is present in most patients. Radiation of the pain to the flanks is more common in pregnant women compared with non-pregnant women with acute bowel obstruction.

Constipation is common during pregnancy; physicians should, therefore, ask patients about any differences between their usual constipation patterns and current bowel movement habits.

Abdominal tenderness with high-pitched bowel sounds is not seen in pregnant women with acute bowel obstruction. Bowel sounds are usually normal on auscultation, in contrast to the absence of bowel sounds in non-pregnant patients with acute bowel obstruction.

In acute bowel obstruction, the imaging modality of choice is an **upright plain radiograph of the abdomen**. The **radiation dose is minimal** from a single radiograph.

Urolithiasis

Flank pain is present in almost all cases of urolithiasis. **Nausea, vomiting, dysuria, fever, and hematuria** are also common findings. In one-quarter of patients, a history of a prior episode of ureteric or renal colic is present. **Costovertebral angle tenderness** is present in all cases.

Ultrasonography is used to check for signs suggestive of obstruction rather than the actual visualization of the stone itself. Right-sided ureteric and calyces dilation can be seen in a normal pregnancy.

Obstetric and Gynecologic Causes

Ovarian Cyst

A ruptured ovarian cyst presents with a **history of mild trauma**. Pelvic pain is common. The patient may be in shock if severe hemorrhage occurs. Ultrasonography can show free fluid in the cul-de-sac in cases of ruptured ovarian cyst.

Adnexal Torsion

Adnexal torsion presents with **acute, severe, colicky, unilateral, lower pelvic pain**. Nausea and vomiting are seen in two-thirds of patients. A **tender adnexal mass** is found in almost all patients.

Ultrasonography with color Doppler is useful in confirming the diagnosis and assessing ovarian blood flow to the central ovarian parenchyma. Diagnostic laparoscopy is indicated in difficult equivocal cases.

Degenerating Myoma

Degenerating myoma presents with very **well localized abdominal or pelvic acute pain**, tenderness, and vomiting. Ultrasonography can be used to confirm the diagnosis. The probe should be placed directly on the painful area.

Placental Abruption

Placental abruption can occur in **hypertensive patients**, those who **use cocaine, and cigarette smokers**. Vaginal bleeding, pelvic and back pain, hypertonic uterus, and non-reassuring fetal heart rate are the most common findings in placental abruption. **Ultrasonography** can be used. If negative, MRI is indicated. Ultrasonography can detect only 25% of cases of placental abruption.

References

Taylor, Dana. 2016. "[Acute Abdomen and Pregnancy.](http://emedicine.medscape.com/article/195976-overview#a1)" Available at: <http://emedicine.medscape.com/article/195976-overview#a1>

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