Evaluating the Acute Abdomen in the Pregnant Patient

Gabriele Masselli, MD[a,*], Martina Derme, MD[b], Francesca Laghi, MD[a], Marialuisa Framarino-dei-Malatesta, MD[b], Gianfranco Gualdi, MD[a]

KEYWORDS

• Acute abdominal pain • Pregnancy • Ultrasound • Computed tomography • MR imaging

KEY POINTS

- US and MR imaging are the preferred investigations for acute abdominal pain during pregnancy.
- US remains the primary imaging investigation because of availability and portability.
- MR imaging helps differentiate causes of acute abdominal pain when US is inconclusive.

INTRODUCTION

The management of acute abdominal pain in pregnancy is challenging for a variety of reasons. Complications and conditions that are associated with or unrelated to pregnancy (urinary tract disorders, gastrointestinal and vascular diseases) may cause abdominal pain or the acute abdomen.[1] The diagnosis of acute abdominal pain in pregnant women is particularly difficult because of multiple confounding factors related to normal pregnancy: nonspecific leukocytosis, displacement of abdominal and pelvic structures from their normal locations by the gravid uterus, difficult abdominal examination, and nonspecific nausea and vomiting.[2] Prompt diagnosis and treatment are crucial for the well-being of the mother and the fetus, and imaging is often required to clarify the clinical picture. Because of exposure of the fetus to ionizing radiation, computed tomography (CT) or plain abdominal radiographs are not the imaging modalities of choice in these patients. Ultrasound (US) and MR imaging are the preferred primary imaging investigations of pregnancy, because of the lack of ionizing radiation.

US is widely used as the initial diagnostic imaging technique during pregnancy because of its availability, portability, and lack of ionizing radiation. US can elucidate the cause of abdominal pain, particularly if pain is caused by an obstetric and gynecologic abnormality. However, evaluation of the bowel, pancreas, ureters, and mesenteric vasculature may be limited on US because of patient body habitus, a small field of view, and the presence of overlying structures. Air within the bowel can particularly limit evaluation of the mesenteric vessels, pancreas, and bowel.

MR imaging is often used when US is inconclusive. CT is used more sparingly in pregnancy because of its level of ionizing radiation. It is the investigation of choice when there is a life-threatening situation and in case of traumatic injuries when a rapid diagnosis is required.[3] This article explains the role of the different imaging

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[a] Radiology Department, Umberto I Hospital, Sapienza University, Viale del Policlinico 155, Rome 00161, Italy;
[b] Department of Gynecological, Obstetrical and Urological Sciences, Sapienza University, Viale del Policlinico 155, Rome 00161, Italy
* Corresponding author.
E-mail address: g.masselli@policlinicoumberto1.it

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techniques for the diagnosis and the management of the most common causes of acute abdominal pain during pregnancy.

IMAGING TECHNIQUE AND SAFETY

US is the first-line diagnostic test in pregnant women with acute abdominal pain, because of the universal availability, the low cost, and the lack of ionizing radiation. Limitations of US include operator dependency, altered body habitus, small field of view, and presence of interfering overlying structures. There are no documented adverse fetal effects of diagnostic US. The US Food and Drug Administration proposed an upper limit of 720 mW/cm^2 for spatial-peak temporal average intensity. Doppler US should be limited to the minimum necessary for clinical diagnosis and its use is discouraged in the first trimester.[4]

The American College of Radiology states that MR imaging is a useful problem-solving tool in the evaluation of abdominal and pelvic pain during pregnancy.[5] It is the preferred investigation when US is inconclusive. The potential advantages of MR imaging are multiplanar imaging capabilities and the ability to detect and distinguish blood from other fluid collections. A comprehensive multiplanar imaging protocol is used to evaluate the most common causes of acute abdominal pain. The protocol includes breath-hold multiplanar T2-weighted sequences based on the half-Fourier reconstruction technique (half-Fourier RARE or single-shot fast spin echo) and balanced gradient echo sequences (FIESTA, true FISP), axial and sagittal T1-weighted gradient-recalled echo sequences, and axial and sagittal diffusion sequences. The time required for this MR protocol is 20 minutes (Table 1).[3]

The detection of acute inflammatory changes is a critical component in the imaging of acute abdominal pain, and MR imaging is sensitive for depiction of inflammation by demonstration of elevated T2 signal within, or adjacent to, the affected tissues. The elevated abnormal T2 signal related to inflammatory disease processes has the potential to be obscured by the inherent high signal of intraperitoneal and retroperitoneal fat. Thus, the acquisition of an additional T2 single-shot sequence that is combined with reliable, high-quality fat suppression is an important component of any abdominopelvic MR imaging. Fat suppression using a spectral adiabatic inversion-recovery technique has been found to produce improved suppression of lipid signal over conventional inversion recovery or spectral saturation techniques. This spectral adiabatic inversion-recovery technique allows the fat-suppressed T2-weighted images to serve as a sensitive marker sequence for edema and inflammatory changes. Compared with CT, the detection of edema with fat-suppressed T2 single-shot MR imaging sequences provides higher levels of contrast and therefore higher sensitivity and specificity for inflammatory changes in the affected tissues and in the surrounding retroperitoneal and mesenteric fat.

Table 1
MR imaging parameters

	Balanced Gradient Echo Sequence (FIESTA, True FISP, BSSFP)		T2 Half-Fourier Sequence (HASTE)		T1 Three-Dimensional Sequence Gradient Echo Sequence	Diffusion-Weighted Image
Parameter	Axial	Coronal/ Sagittal	Axial/ Axial Fat Sat	Coronal/ Sagittal	Axial/Sagittal	Axial, Coronal
Repetition time/echo time (ms)	4.3/2.2	4.3/2.2	1000/90	1000/90	4.1/1.1	3200/75
Flip angle (degrees)	50	50	150	150	10	10
Field of view (mm)	320–400	320–400	320–400	320–400	320–400	320–400
Matrix	256 × 224	256 × 224	256 × 224	256 × 224	256 × 224	256 × 192
Parallel imaging factor	2	2	2	2	3	2
Section thickness (mm)	5	5	4	4	2.5	10
Intersection gap (mm)	0	0	0	0	0	0
NEX	1	1	1	1	1	6
Receiver bandwidth	125	125	62.50	62.50	62.50	1930