

MR Imaging of Pelvic Emergencies in Women

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KEYWORDS

- Female pelvis • Adnexa • Pelvic emergencies • Pregnancy • Pelvic pain • MR imaging
- Appendicitis

KEY POINTS

- Lower abdominal/pelvic pain is one of the commonest presenting complaints for emergency department visits in women of all ages.
- Imaging plays a key role in diagnosis, triage, and management of these patients with appropriate clinical and laboratory correlation.
- Although pelvic sonography remains the imaging modality of choice in initial assessment of these women, MR imaging has proven to be an excellent adjunct modality in evaluation of indeterminate or equivocal sonographic findings, especially in pregnant women.
- Radiologists should be familiar with commonly encountered pelvic emergencies in pregnant and nonpregnant women, including the spectrum of MR imaging features, to make correct and timely diagnoses and facilitate appropriate patient management.

INTRODUCTION

Lower abdominal/pelvic pain is one of the most common presenting symptoms for emergency department (ED) visit among women of all ages.^{1,2} These symptoms can be attributed to gynecologic, urologic, gastrointestinal, or other causes. Several of these entities may have nonspecific clinical and laboratory findings, presenting a dilemma for clinical decision making and patient care. Imaging remains an integral component in patient evaluation, directing the diagnosis and management in many cases. Ultrasonography is an established first-line imaging modality in evaluation of female pelvic

symptoms in the emergent and nonemergent setting due to its wide accessibility, cost-effectiveness, and lack of ionizing radiation with acceptable sensitivity and specificity in diagnosing most pelvic pathologies.³ Although computed tomography (CT) is the imaging test of choice for many diseases in the ED, it is rarely the first choice when acute gynecologic pathologies are suspected, due to poor soft tissue contrast of the pelvic reproductive organs and the use of ionizing radiation.⁴ Over the past few decades, MRI has emerged as an excellent second-line imaging option in patients with inconclusive sonographic findings and/or contraindication to CT (mostly

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pregnancy), due to its lack of ionizing radiation, superior soft tissue resolution, and technological advancements allowing for isotropic, multiplanar imaging.^{5–7}

This article presents a comprehensive review of the role of MR imaging in pelvic emergencies in pregnant and nonpregnant patients. Although the major emphasis is on gynecologic pathologies, commonly encountered gastrointestinal pathologies are also presented.

IMAGING PROTOCOLS

Although MR imaging of the pelvis may be performed at 1.0, 1.5, or 3.0 T, 3.0 T is preferred because of superior signal to noise ratio, spatial resolution, and shorter acquisition time afforded by the higher magnetic field strength. A multi-channel phased array surface coil is used, which allows for parallel imaging to speed up acquisition time while increasing spatial resolution.⁸ An intramuscular injection of glucagon (an antiperistaltic agent) may be administered to suppress bowel motion, improving visualization of the adnexal and peritoneal surfaces. The patient's pregnancy status must be ascertained before administration of gadolinium-based contrast agents, which are contraindicated in pregnancy.⁹

At our institution, we obtain the following sequences on our routine MRI pelvis studies in nonpregnant patients on either a 1.5-T or preferably 3.0-T magnet (depending on magnet availability), summarized in **Tables 1** and **2**. The first sequence is a rapidly acquired, heavily T2-

weighted (T2W) sequence (single-shot fast spin echo [SSFSE]) in the coronal plane. The sagittal T2W fast spin echo (FSE) is performed with smaller field of view and higher spatial resolution, and is especially useful for assessing the orientation of the uterus ("uterine lie"), to demonstrate the uterine zonal anatomy, and evaluate anatomic landmarks for subsequent sequences. Based on the uterine lie, short and long axis, T2W images (FSE) are then obtained. T1-weighted (T1W) sequences with in-phase and opposed-phase imaging and with fat suppression are obtained to aid in the detection of lipid-rich lesions and distinguish them from hemorrhagic and/or proteinaceous cysts. Depending on the clinical indication and the patient's pregnancy status, contrast-enhanced images may be acquired after the intravenous administration of gadolinium by using fat-saturated T1W sequence (spoiled gradient recalled echo). **Table 3** summarizes the protocol used in pregnant patients suspected of having acute appendicitis.

PREGNANCY-RELATED EMERGENCIES

Ectopic Pregnancy

Ectopic pregnancy refers to implantation of the fertilized ovum outside the endometrial cavity. It constitutes approximately 2% of total pregnancies and is a leading cause of maternal death in the first trimester of pregnancy.^{10,11} Most ectopic pregnancies occur in the ampullary and isthmic portions of the fallopian tube, with other rare sites being interstitial, adnexal, cervical, and ovarian.¹²

Table 1

Suggested female pelvic MR protocol at 1.5-T magnet (GE scanner): female pelvis (nonpregnant)

	Coronal T2	Sagittal T2	Oblique Long Axis T2	Oblique Short-Axis T2	Axial T1 In/Out-Phase	Axial DWI	Axial T1-FS Pre and Postcontrast
Pulse sequence	SSFSE	FSE	FSE	FSE	SPGR	EPI	SPGR
Repetition time, ms	4000	3000–5000	3000–5000	3000–5000	185	Shortest	Shortest
Echo time, ms	100	90	120	120	2.3/4.6	Shortest	Shortest
Matrix, frequency × phase	256 × 128	512 × 224	512 × 224	512 × 224	256 × 160	128 × 128	320 × 160
Slice thickness, mm	5	5	4	4	5	5	4
Flip angle	90	90	90	90	70	90	7
FOV	40	24–32	20–24 (to fit)	20–24 (to fit)	28–34	40	20–24 (to fit)

Abbreviations: DWI, diffusion-weighted imaging; EPI, echo planar imaging; FOV, field of view; FS, fat saturation; FSE, fast spin echo; SPGR, spoiled gradient recalled echo; SSFSE, single-shot fast spin echo; TSE, turbo spin echo.

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