

Common Questions About the Evaluation of Acute Pelvic Pain

AMIT K. BHAVSAR, LTC, MC, USA; ELIZABETH J. GELNER, CPT, MC, USA; and TONI SHORMA, CPT, MC, USA
Tripler Army Medical Center, Honolulu, Hawaii

Acute pelvic pain is defined as lower abdominal or pelvic pain of less than three months' duration. It is a common presentation in primary care. Evaluation can be challenging because of a broad differential diagnosis and because many associated signs and symptoms are nonspecific. The most common diagnoses in reproductive-aged women with acute pelvic pain are idiopathic pelvic pain, pelvic inflammatory disease, acute appendicitis, ovarian cysts, ectopic pregnancy, and endometriosis. Among postmenopausal women, cancer must be considered. Findings from the history and physical examination can point to likely diagnoses, and laboratory testing and imaging can help confirm. Women of reproductive age should take a pregnancy test. In early pregnancy, transvaginal ultrasonography and beta human chorionic gonadotropin levels can help identify ectopic pregnancy and spontaneous abortion. For nonpregnant women, ultrasonography or computed tomography is indicated, depending on the possible diagnosis (e.g., ultrasonography is preferred when ovarian pathology is suspected). If ultrasonography results are nondiagnostic, magnetic resonance imaging can be helpful in pregnant women when acute appendicitis is suspected. If magnetic resonance imaging is unavailable, computed tomography may be indicated. (*Am Fam Physician*. 2016;93(1):41-48. Copyright © 2016 American Academy of Family Physicians.)



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Acute pelvic pain is often defined as lower abdominal or pelvic pain lasting less than three months.¹ Although most patients with acute pelvic pain are diagnosed with one of a few common conditions, the differential diagnosis is broad. Many case studies describe acute pelvic pain caused by conditions that are uncommon but clinically important.

Acute pelvic pain is a common presentation in primary care. Although well-designed studies on the prevalence of pelvic pain are lacking, one study estimated that up to 39% of reproductive-aged women who presented to their primary care physician had symptoms related to pelvic pain, and one in seven women has acute or chronic pelvic pain at some point.^{2,3} The consequence of a missed diagnosis can be serious. For example, delay in diagnosis of an ectopic pregnancy can result in rupture and life-threatening hemorrhage. Untreated sexually transmitted infections and pelvic inflammatory disease (PID) can lead to long-term sequelae, such as infertility and chronic pain.

The workup of acute pelvic pain in the office setting can be challenging. This article provides an evidence-based framework to

narrow the differential diagnosis while assuring that serious conditions are not missed.

How Do Physicians Narrow the Differential Diagnosis to Focus on Important Common Conditions?

Physicians should first categorize the patient according to age (e.g., is she in her reproductive years or postmenopausal?). If the patient is of reproductive age, possible diagnoses are next categorized by whether she is pregnant or attempting pregnancy.

NONPREGNANT REPRODUCTIVE-AGED WOMEN

The typical diagnoses made in nonpregnant reproductive-aged women who present with acute pelvic pain include the following (from most to least common): idiopathic pelvic pain, PID, acute appendicitis, conditions related to ovarian cysts, and endometriosis.^{4,5} Other less common causes of acute pelvic pain in this population are listed in *Table 1*.⁶⁻⁹

REPRODUCTIVE-AGED WOMEN WHO ARE PREGNANT OR ATTEMPTING PREGNANCY

Women who are pregnant or attempting pregnancy through fertility treatments have

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendations</i>	<i>Evidence rating</i>	<i>References</i>
When patients have adnexal tenderness with cervical motion tenderness, pelvic inflammatory disease should be considered as a likely diagnosis.	C	13
A normal transvaginal ultrasonography with Doppler flow study does not necessarily rule out ovarian torsion. Although it has a high positive predictive value for detecting ovarian torsion, it also has a high false-negative rate.	C	26
Transvaginal ultrasonography should be the initial imaging test in pregnant women presenting with acute pelvic pain.	C	31
If transvaginal ultrasonography is nondiagnostic in pregnant patients and additional imaging is required, magnetic resonance imaging should be used instead of computed tomography.	C	32-34

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort>.

other common causes of acute pelvic pain (Table 1⁶⁻⁹). For pregnant women, the clinical scenario narrows the list of possible causes, but it is critical to detect serious or life-threatening conditions, such as ectopic pregnancy in the early weeks of pregnancy and placental abruption in the later stages of pregnancy. Nongynecologic conditions, such as appendicitis, can also occur during pregnancy.

Women undergoing infertility treatments through ovarian stimulation or in vitro fertilization have unique risks, such as ovarian hyperstimulation syndrome (i.e., ovarian enlargement with multiple ovarian cysts and leakage of fluid from the ovary into the abdominal/pelvic space), ovarian torsion, and heterotopic pregnancy (i.e., simultaneous ectopic and intrauterine pregnancy).⁶

POSTMENOPAUSAL WOMEN

Cancer must be primarily considered in a postmenopausal woman with acute pelvic pain. Other rare causes are postmenopausal endometriosis¹⁰ and, on occasion, a retained intrauterine device that the patient had forgotten to remove.¹¹

Which History and Physical Examination Findings Are Most Helpful in Evaluating Acute Pelvic Pain?

HISTORY

Several findings in the patient's history can help guide laboratory testing and imaging to confirm a suspected diagnosis (Table 2^{6,7,9}). Relevant historical features

include whether the patient is sexually active (e.g., pain related to a complication of pregnancy), specific symptoms (e.g., description of the pain; changes in menstrual pattern; the presence of vaginal discharge, dysuria, hematuria, or nausea), and whether she has had intrauterine instrumentation or pelvic surgery. A recent study reported rare occurrences of PID in women who denied ever having sexual intercourse, illustrating the need for a high index of suspicion for this condition.¹²

PHYSICAL EXAMINATION

The physical examination should focus on vital signs, abdominal examination, bimanual pelvic examination, and speculum examination (Table 3^{6,7,9} and eTable A). Hypotension, tachycardia, or evidence of guarding or rebound on abdominal examination could indicate a surgical emergency (e.g., ruptured ectopic pregnancy, ovarian torsion, ruptured appendix) and should prompt immediate referral.

If vital signs are unremarkable and there is no evidence of an acute abdomen, vaginal and pelvic examinations are the next steps. A mucopurulent cervical discharge, especially if accompanied by fever and leukocytosis, is suggestive of PID. When cervical discharge is combined with diffuse tenderness (cervical motion tenderness and bilateral adnexal tenderness) on pelvic examination, the likelihood of PID increases. However, cervical motion tenderness alone is not specific to PID; it is present in 25% of cases of appendicitis and 50% of ectopic pregnancies.^{13,14}

When tenderness is unilateral or an adnexal mass is palpated, the cause of pain is more likely to be a localized process, such as an ovarian cyst, ovarian torsion, or ectopic pregnancy. However, pelvic examination has a sensitivity of only 15% to 36% for detecting adnexal masses,¹⁵ so the absence of a palpable mass should not preclude consideration of these conditions.

Appendicitis often presents with right lower quadrant pain over McBurney point with nausea, vomiting, and

WHAT IS NEW ON THIS TOPIC: ACUTE PELVIC PAIN

C-reactive protein measurement is not recommended in the routine evaluation of acute pelvic pain because of a high false-negative rate for acute conditions.

If computed tomography has already been performed and is unrevealing, follow-up transvaginal ultrasonography is unlikely to provide additional useful information.

Table 1. Conditions Causing Acute Pelvic Pain in Different Populations

<i>Patient category</i>	<i>Common diagnoses</i>	<i>Less common diagnoses</i>	<i>Rare diagnoses</i>
Reproductive age (not pregnant)	Endometriosis (ruptured endometrioma) Idiopathic (no cause identified) Ovarian cyst, ruptured Ovarian torsion PID, tubo-ovarian abscess	Adenomyosis Dysmenorrhea Endometritis (postprocedure) Imperforate hymen Intrauterine device perforation Leiomyoma (degenerating) Mittelschmerz	Endosalpingiosis Round ligament mass (lipoma, teratoma) Transverse vaginal septum
Reproductive age (pregnancy related)	Corpus luteum cyst Ectopic pregnancy Endometritis (postpartum) Normal labor Ovarian torsion PID (first trimester) Placental abruption Preterm labor Spontaneous abortion	Leiomyoma (degenerating) Pubic symphysis separation Subchorionic hemorrhage	Incarcerated gravid uterus Ovarian vein thrombosis PID (rare after first trimester) Uterine rupture
Reproductive age (undergoing fertility treatment)	Ectopic pregnancy Ovarian follicular cyst Ovarian hyperstimulation syndrome Ovarian torsion	—	Heterotopic pregnancy
Postmenopausal	Malignancy	Ischemic colitis	Endometriosis PID, tubo-ovarian abscess Retained intrauterine device
All groups	Appendicitis Diverticulitis Inflammatory bowel disease Irritable bowel syndrome Musculoskeletal (abdominal wall) pain Urinary tract infection Urolithiasis	Bowel obstruction Inguinal hernia Interstitial cystitis Pelvic adhesive disease (postoperative scarring) Perirectal abscess Urethral diverticulum Urinary retention	Mesenteric adenitis

PID = pelvic inflammatory disease.

Information from references 6 through 9.

occasionally fever. Rovsing sign, which is less well known, involves palpation in the left lower quadrant that causes pain in the right lower quadrant. Although not specific, it has a sensitivity of greater than 90% for appendicitis.¹⁶ Right lower quadrant tenderness with digital rectal examination was shown to be only 49% sensitive and 61% specific for appendicitis, and thus may only add to patient discomfort without providing useful information.¹⁷

Finally, musculoskeletal pain often causes pelvic pain and can mimic visceral pelvic pain. This is usually a diagnosis of exclusion after ruling out intrapelvic and intra-abdominal causes. Carnett sign, which is the presence of increased pain on palpation of the lower abdominal wall when the abdominal wall musculature

is voluntarily contracted, can indicate a musculoskeletal cause. Although first proposed in 1926, a more recent study validated use of the Carnett sign and found a sensitivity and specificity of 78% and 88%, respectively, for identifying pain originating in the abdominal wall.^{18,19}

An algorithm for using physical examination findings to evaluate selected common causes of pelvic pain in nonpregnant women is shown in *Figure 1*.²⁰

What Are the Roles of Laboratory Tests and Imaging Studies in Evaluating Acute Pelvic Pain?

Laboratory tests and imaging studies are largely guided by history and physical examination findings to identify possible causes of pelvic pain (*Tables 2^{6,7,9} and 3^{6,7,9}*).

Table 2. Historical Findings and Suggested Diagnoses and Subsequent Testing in Patients with Acute Pelvic Pain

<i>Finding</i>	<i>Suggested diagnoses</i>	<i>Further diagnostic considerations</i>
History of intrauterine instrumentation, multiple cesarean deliveries, or other uterine surgeries	Adenomyosis (endometrial tissue grown into the uterine wall) Pelvic adhesions	Magnetic resonance imaging Consider nonurgent referral to gynecologist or general surgeon in absence of other findings
Menstrual abnormalities		
Amenorrhea	Imperforate hymen Transverse vaginal septum	Pelvic examination Pelvic ultrasonography
Dysmenorrhea	Endometriosis, ovarian cyst	Pelvic ultrasonography (to assess for ovarian cyst)
Nausea and vomiting	Appendicitis, ovarian torsion	If appendicitis is more likely: proceed with contrast CT If ovarian torsion is more likely: proceed with pelvic ultrasonography with Doppler flow study Early urgent referral for surgical evaluation and treatment is recommended
Pain symptoms		
Bilateral pain, particularly if associated with mucopurulent vaginal discharge	Pelvic inflammatory disease	Testing for sexually transmitted infections Complete blood count to test for leukocytosis or left shift
Dull, unilateral adnexal pain that is constant or intermittent	Ovarian torsion	Presence of risk factors (nausea, vomiting, pregnancy) Pelvic ultrasonography with Doppler flow study Consider urgent referral for surgical evaluation and treatment
Right lower quadrant pain	Acute appendicitis Ectopic pregnancy Ovarian torsion	Complete blood count demonstrating leukocytosis Contrast CT of the abdomen and pelvis Qualitative urine β -hCG can detect a pregnancy at four weeks' gestation Quantitative serum β -hCG can determine if pregnancy is above the discriminatory level such that an intrauterine pregnancy should be visible on pelvic ultrasonography to rule out ectopic gestation (Figure 2) Blood type to determine Rh status; if bleeding and pregnant, will need Rh ₀ (D) immune globulin (RhoGam) Pelvic ultrasonography Pelvic ultrasonography with Doppler flow study
Sexually active; pregnancy possible	Ectopic pregnancy, spontaneous abortion	Qualitative urine β -hCG can detect a pregnancy at four weeks' gestation Quantitative serum β -hCG can determine if pregnancy is above the discriminatory level such that an intrauterine pregnancy should be visible on pelvic ultrasonography to rule out ectopic gestation (Figure 2) Blood type to determine Rh status; if bleeding and pregnant, will need Rh ₀ (D) immune globulin Pelvic ultrasonography
Urinary symptoms		
Dysuria	Urinary tract infection	Urinalysis demonstrating white blood cells, bacteria, leukocyte esterase, or nitrites
Gross hematuria	Urolithiasis	Abdominal ultrasonography

β -hCG = beta human chorionic gonadotropin; CT = computed tomography.
Information from references 6, 7, and 9.

LABORATORY TESTS

A qualitative pregnancy test should be performed in all women of reproductive age to determine if pregnancy-related conditions are causing pelvic pain. Other commonly performed initial laboratory tests include a complete blood count, urinalysis, and nucleic acid amplification testing for gonococcal and chlamydial cervicitis.

C-reactive protein is a possible marker to discriminate acute processes requiring urgent intervention from chronic conditions. A recent study, however, demonstrated that C-reactive protein measurement has a high false-negative rate for detecting acute conditions²¹; therefore, it is not recommended in the routine evaluation of acute pelvic pain.

IMAGING

Although plain radiography of the abdomen and pelvis is widely available, it lacks sensitivity and diagnostic accuracy compared with other modalities (e.g., ultrasonography, computed tomography [CT]) in the evaluation of acute pelvic pain.²² For this reason, plain radiography is not indicated in the routine workup of acute pelvic pain.

Pelvic ultrasonography, consisting of transabdominal combined with transvaginal ultrasonography, is usually the imaging modality of choice because of a lack of radiation exposure and high sensitivity.²³ It should be performed in most cases and is the initial imaging modality of choice in children.^{24,25} When ovarian torsion is suspected, Doppler venous flow studies should

Table 3. Physical Examination Findings and Suggested Diagnoses and Subsequent Testing in Patients with Acute Pelvic Pain

<i>Finding</i>	<i>Suggested diagnoses</i>	<i>Further diagnostic considerations</i>
Carnett sign (increased pain to palpation when the abdominal wall musculature is voluntarily contracted)	Musculoskeletal (abdominal wall) pain	No further testing needed in the absence of other historical or physical examination findings that might suggest intrapelvic or intra-abdominal conditions
Cervical motion tenderness	Pelvic inflammatory disease	Consider testing for sexually transmitted infections
Fever	Appendicitis	Ultrasonography or contrast CT of the abdomen and pelvis Complete blood count demonstrating leukocytosis
	Pelvic inflammatory disease	Consider testing for sexually transmitted infections
	Pyelonephritis	Urinalysis demonstrating evidence of urinary tract infection (white blood cells, bacteria, leukocyte esterase, or nitrites) Complete blood count demonstrating leukocytosis, left shift
	Tubo-ovarian abscess	Pelvic ultrasonography Complete blood count demonstrating leukocytosis, left shift
Pelvic mass	Ectopic pregnancy	See Table 2
	Fibroid uterus	Pelvic ultrasonography
	Ovarian cancer	Pelvic ultrasonography Consider CT of the chest, abdomen, and pelvis if metastatic disease is suspected
	Ovarian cyst	Pelvic ultrasonography
	Tubo-ovarian abscess	Pelvic ultrasonography
Rovsing sign (palpation in the left lower quadrant causes pain in the right lower quadrant)	Appendicitis	Contrast CT of the abdomen and pelvis Complete blood count demonstrating leukocytosis
Tachycardia, hypotension	Ruptured ectopic pregnancy Ruptured hemorrhagic cyst	Consider urgent referral to facility with immediate surgical capability

CT = computed tomography.

Information from references 6, 7, and 9.

Acute Pelvic Pain

be part of the ultrasonography examination. Absent venous flow to the ovary has a 94% positive predictive value for ovarian torsion.⁷ However, transvaginal ultrasonography with Doppler flow studies also has a high false-negative rate for ovarian torsion because of the dual blood supply from the ovarian artery and the utero-ovarian vessels. Flow can be demonstrated even when torsion is present. Therefore, if the Doppler study result is negative, ovarian torsion should still be considered if the patient has peritoneal signs and risk factors for torsion, such as nausea and vomiting, an adnexal mass greater than 5 cm, or pregnancy.^{26,27}

Ultrasonography can be useful even when pain may have a nongynecologic cause. In one series of 500 cases, abdominal ultrasonography demonstrated a 76% sensitivity and 90% specificity for diagnosing appendicitis.²⁸ A more recent study demonstrated higher sensitivity and specificity of 94% and 84%, respectively, albeit

with a smaller study population.²⁹ Currently, however, if acute appendicitis is suspected over gynecologic conditions (e.g., a nonpregnant woman with isolated right lower quadrant pain and nausea), or if ultrasonography does not clearly show a normal appendix, CT is still considered more accurate, with a sensitivity of 94% to 97% and specificity up to 100%.^{28,30} CT use has led to a decrease in laparotomies performed for suspected appendicitis in which the final pathology was negative for acute appendicitis. CT is also appropriate to evaluate acute pelvic pain if ultrasonography is not readily available.

What Is the Imaging Test of Choice for Pregnant Women with Acute Pelvic Pain?

In early pregnancy, the most important consideration is to identify the location of the gestation to exclude ectopic pregnancy. Transvaginal ultrasonography is the imaging modality of choice, but results must be correlated with beta human chorionic gonadotropin (β -hCG) levels and, in particular, the discriminatory level (the β -hCG level at which the gestation should be visible on ultrasonography).³¹ Figure 2 provides an algorithm for the evaluation and follow-up of patients with a positive β -hCG level and pelvic pain.²⁰

In early pregnancy, if the β -hCG level is below the discriminatory level and an intrauterine gestation is not visible, the patient must have follow-up evaluations until ectopic pregnancy or a viable pregnancy is confirmed. If the β -hCG level is above the discriminatory level and the intrauterine gestational sac and yolk sac are not visible on ultrasonography, the pregnancy is likely ectopic and gynecologic consultation should be obtained.

If the diagnosis is still uncertain in the absence of ectopic pregnancy or spontaneous abortion, magnetic resonance imaging (MRI) can be used to further evaluate pelvic and abdominal structures.³² MRI provides high-quality images to assess the placenta and exclude abruption, and it has sensitivities and specificities close to 100% for acute appendicitis.^{33,34} MRI is also useful for detecting conditions such as inflammatory bowel disease, nephrolithiasis, adnexal masses, ovarian hemorrhagic cysts, and large uterine fibroids.

CT may be the only imaging option if MRI is unavailable, if ultrasonography is

Evaluation of Selected Common Causes of Acute Pelvic Pain After Ruling Out Pregnancy

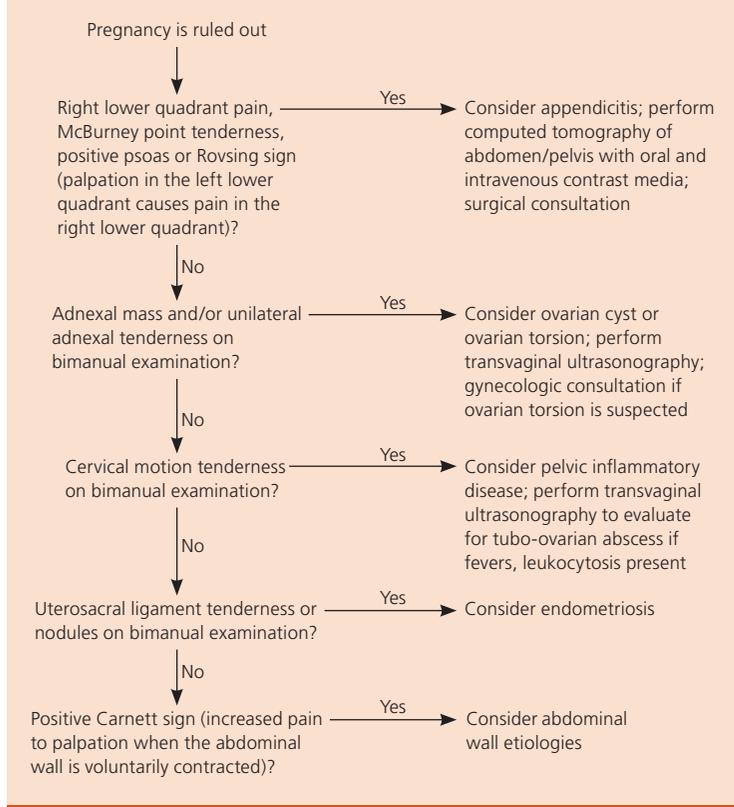
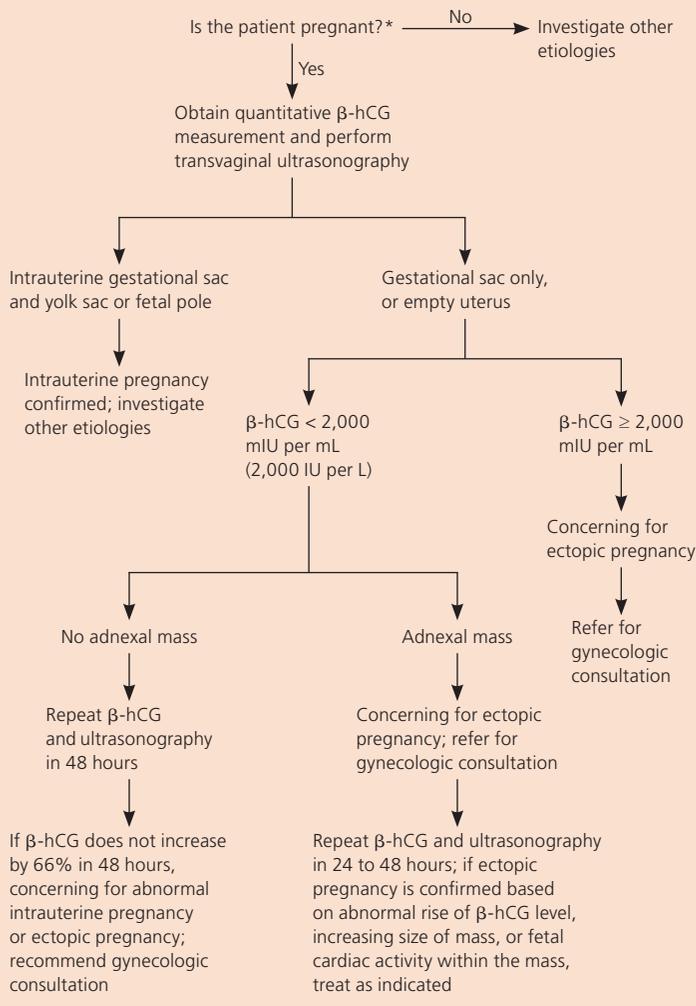


Figure 1. Evaluation of selected common causes of acute pelvic pain after ruling out pregnancy.

Information from reference 20.

Ultrasonography and Laboratory Evaluation of a Patient in Early Pregnancy with Acute Pelvic Pain



*—If at any time the patient becomes unstable, recommend acute surgical or gynecologic consultation.

Figure 2. Ultrasonography and laboratory evaluation of a patient in early pregnancy with acute pelvic pain. (β -hCG = beta human chorionic gonadotropin.)

Information from reference 20.

unavailable or inconclusive, and if the patient's condition requires imaging for diagnosis. The fetal exposure from a single pelvic CT is estimated to be 1.5 rad, or less if low-exposure techniques are used. This level of exposure is thought to increase the lifetime risk of leukemia in the exposed fetus by a factor of 1.5 to 2. The baseline lifetime incidence of childhood leukemia is low (one in

3,000), so a single CT increases the risk to only 1.5 to 2 per 3,000.^{35,36} Thus, in appropriate clinical scenarios, the benefit of diagnostic CT may outweigh the risk.

Is Additional Imaging Helpful if CT Results Are Inconclusive?

From a technical standpoint, transvaginal ultrasonography is superior for obtaining images of contrasting pelvic soft tissue, especially fluid-filled structures, and can reliably assess for adnexal masses, cysts, uterine fibroids, and the size and location of ovaries and luminal structures. It can also identify pelvic fluid or blood extravasation and provide Doppler flow studies.

If CT has already been performed and is unrevealing, follow-up ultrasonography is not likely to provide additional useful information. One small study showed that follow-up transvaginal ultrasonography did not provide information that changed the working diagnosis.⁸ In such cases, discussions with the radiologist can determine whether additional imaging studies may be helpful.

Data Sources: A PubMed search was performed using the terms acute and pelvic pain, differential diagnosis, and MeSH terms: diagnosis, differential, acute disease, genital diseases, female/diagnosis, pelvic girdle pain, and pelvic pain. Stat!Ref, Books@Ovid, and Clinical Key were searched using keywords pelvic pain, and age. Also searched was Essential Evidence Plus. Search dates: October and December 2014, and April and September 2015.

The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the U.S. Army Medical Department or the U.S. Army at large.

The Authors

AMIT K. BHAVSAR, LTC, MC, USA, is a staff family physician at Tripler Army Medical Center Family Medicine Residency Program, Department of Family Medicine, and Department of Obstetrics and Gynecology, Honolulu, Hawaii. Dr. Bhavsar is also an assistant professor of family medicine at the Uniformed Services University of the Health Sciences in Bethesda, Md.

ELIZABETH J. GELNER, CPT, MC, USA, is a third-year resident in the Tripler Army Medical Center Department of Obstetrics and Gynecology.

TONI SHORMA, CPT, MC, USA, is a second-year resident in the Tripler Army Medical Center Department of Obstetrics and Gynecology.

Address correspondence to Amit K. Bhavsar, LTC, MC, USA, Tripler Army Medical Center, 1 Jarret White Rd, Honolulu, HI 96859 (e-mail: amit.k.bhavsar.mil@mail.mil). Reprints are not available from the authors.

REFERENCES

- Kruszka PS, Kruszka SJ. Evaluation of acute pelvic pain in women. *Am Fam Physician*. 2010;82(2):141-147.
- Mathias SD, Kuppermann M, Liberman RF, Lipschutz RC, Steege JF. Chronic pelvic pain: prevalence, health-related quality of life, and economic correlates. *Obstet Gynecol*. 1996;87(3):321-327.
- Jamieson DJ, Steege JF. The prevalence of dysmenorrhea, dyspareunia, pelvic pain, and irritable bowel syndrome in primary care practices. *Obstet Gynecol*. 1996;87(1):55-58.
- Yeh JM, Hook EW III, Goldie SJ. A refined estimate of the average lifetime cost of pelvic inflammatory disease. *Sex Transm Dis*. 2003;30(5):369-378.
- Morino M, Pellegrino L, Castagna E, Farinella E, Mao P. Acute nonspecific abdominal pain: a randomized, controlled trial comparing early laparoscopy versus clinical observation. *Ann Surg*. 2006;244(6):881-888.
- Svare J, Norup P, Grove Thomsen S, et al. Heterotopic pregnancies after in-vitro fertilization and embryo transfer—a Danish survey. *Hum Reprod*. 1993;8(1):116-118.
- Sasaki KJ, Miller CE. Adnexal torsion: review of the literature. *J Minim Invasive Gynecol*. 2014;21(2):196-202.
- Gao Y, Lee K, Camacho M. Utility of pelvic ultrasound following negative abdominal and pelvic CT in the emergency room. *Clin Radiol*. 2013;68(11):e586-e592.
- Rossi BV, Ference EH, Zurakowski D, et al. The clinical presentation and surgical management of adnexal torsion in the pediatric and adolescent population. *J Pediatr Adolesc Gynecol*. 2012;25(2):109-113.
- Oxholm D, Knudsen UB, Kryger-Baggesen N, Ravn P. Postmenopausal endometriosis. *Acta Obstet Gynecol Scand*. 2007;86(10):1158-1164.
- Padilla CA, Gimpelson RJ. Postmenopausal bleeding due to a Cu-7 intrauterine device retained for thirty years. *JSLs*. 2012;16(2):329-332.
- Cho HW, Koo YJ, Min KJ, Hong JH, Lee JK. Pelvic inflammatory disease in virgin women with tubo-ovarian abscess: a single-center experience and literature review [published online ahead of print August 7, 2015]. *J Pediatr Adolesc Gynecol*. <http://www.sciencedirect.com/science/article/pii/S1083318815002922>. Accessed September 21, 2015.
- Peipert JF, Ness RB, Blume J, et al.; Pelvic Inflammatory Disease Evaluation and Clinical Health Study Investigators. Clinical predictors of endometritis in women with symptoms and signs of pelvic inflammatory disease. *Am J Obstet Gynecol*. 2001;184(5):856-863.
- Quan M. Diagnosis of acute pelvic pain. *J Fam Pract*. 1992;35(4):422-432.
- Padilla LA, Radosevich DM, Milad MP. Accuracy of the pelvic examination in detecting adnexal masses. *Obstet Gynecol*. 2000;96(4):593-598.
- Hatipoglu S, Hatipoglu F, Abdullayev R. Acute right lower abdominal pain in women of reproductive age: clinical clues. *World J Gastroenterol*. 2014;20(14):4043-4049.
- Takada T, Nishiwaki H, Yamamoto Y, et al. The role of digital rectal examination for diagnosis of acute appendicitis: a systematic review and meta-analysis. *PLoS One*. 2015;10(9):e0136996.
- Thomson H, Francis DM. Abdominal-wall tenderness: a useful sign in the acute abdomen. *Lancet*. 1977;2(8047):1053-1054.
- Srinivasan R, Greenbaum DS. Chronic abdominal wall pain: a frequently overlooked problem. Practical approach to diagnosis and management. *Am J Gastroenterol*. 2002;97(4):824-830.
- Crochet JR, Bastian LA, Chireau MV. Does this woman have an ectopic pregnancy? The rational clinical examination systematic review. *JAMA*. 2013;309(16):1722-1729.
- Gans SL, Atema JJ, Stoker J, Toorenvliet BR, Laurell H, Boermeester MA. C-reactive protein and white blood cell count as triage test between urgent and nonurgent conditions in 2961 patients with acute abdominal pain. *Medicine (Baltimore)*. 2015;94(9):e569.
- Gans SL, Stoker J, Boermeester MA. Plain abdominal radiography in acute abdominal pain; past, present, and future. *Int J Gen Med*. 2012;5:525-533.
- Ackerman SJ, Irshad A, Anis M. Ultrasound for pelvic pain II: nongynecologic causes. *Obstet Gynecol Clin North Am*. 2011;38(1):69-83, viii.
- Cicchello LA, Hamper UM, Scoutt LM. Ultrasound evaluation of gynecologic causes of pelvic pain. *Obstet Gynecol Clin North Am*. 2011;38(1):85-114, viii.
- Smith MP, Katz DS, Lalani T, et al. ACR appropriateness criteria. Right lower quadrant pain—suspected appendicitis. *Ultrasound Q*. 2015;31(2):85-91.
- Smorgick N, Maymon R. Assessment of adnexal masses using ultrasound: a practical review. *Int J Womens Health*. 2014;6:857-863.
- Tsafiriz Z, Hasson J, Levin I, Solomon E, Lessing JB, Azem F. Adnexal torsion: cystectomy and ovarian fixation are equally important in preventing recurrence. *Eur J Obstet Gynecol Reprod Biol*. 2012;162(2):203-205.
- Horton MD, Counter SF, Florence MG, Hart MJ. A prospective trial of computed tomography and ultrasonography for diagnosing appendicitis in the atypical patient. *Am J Surg*. 2000;179(5):379-381.
- Arooj S, Haq A, Amin Z. The specificity and sensitivity of ultrasonography in the diagnosis of acute right lower quadrant pain in women of child bearing age. *J Pak Med Assoc*. 2015;65(9):933-936.
- van Randen A, Laméris W, van Es HW, et al.; OPTIMA Study Group. A comparison of the accuracy of ultrasound and computed tomography in common diagnoses causing acute abdominal pain. *Eur Radiol*. 2011;21(7):1535-1545.
- Barnhart KT. Clinical practice. Ectopic pregnancy. *N Engl J Med*. 2009;361(4):379-387.
- Cuevas C, Dubinsky TJ. Imaging evaluation of acute pelvic pain in reproductive age women: what is the best study? *Ultrasound Q*. 2011;27(3):211-213.
- Lubarsky M, Kalb B, Sharma P, Keim SM, Martin DR. MR imaging for acute nontraumatic abdominopelvic pain: rationale and practical considerations. *Radiographics*. 2013;33(2):313-337.
- Long SS, Long C, Lai H, Macura KJ. Imaging strategies for right lower quadrant pain in pregnancy. *AJR Am J Roentgenol*. 2011;196(1):4-12.
- Brent RL. The effect of embryonic and fetal exposure to x-ray, microwaves, and ultrasound: counseling the pregnant and nonpregnant patient about these risks. *Semin Oncol*. 1989;16(5):347-368.
- ACOG Committee Opinion. Number 299, September 2004. Guidelines for diagnostic imaging during pregnancy. *Obstet Gynecol*. 2004;104(3):647-651.

Table A. Likelihood Ratios and Posttest Probabilities for Diagnostic Findings of Acute Pelvic Pain

Finding	LR+‡	LR-‡	Posttest probability* (5% pretest probability†)		Posttest probability* (25% pretest probability†)	
			Finding present	Finding absent	Finding present	Finding absent
Pelvic inflammatory disease						
Purulent endocervical discharge	3.3	0.8	15	4	52	21
Abdominal rebound tenderness	2.5	0.8	12	4	45	21
Fever	1.3	0.8	6	4	30	21
Leukocyte count > 10,500 per mm ³ (10.50 × 10 ⁹ per L)	1.3	0.9	6	5	30	23
Erythrocyte sedimentation rate > 15 mm per hour	1.2	0.6	6	3	29	17
Cervical motion tenderness	1.1	0.9	5	5	27	23
Pelvic organ tenderness	1.0	1.0	5	5	25	25
Ectopic pregnancy						
Finding of any noncystic, extraovarian adnexal mass on ultrasonography	27.0	0.01	59	0	90	0
β-hCG < 1,000 mIU per mL (1,000 IU per L)§	3.6	0.7	16	4	55	19
Indeterminate ultrasonography and β-hCG < 1,000 mIU per mL§	2.6	0.4	12	2	46	12
Appendicitis						
Right lower quadrant abdominal pain	8.4	0.2	31	1	74	6
Pain migration from periumbilical area to the right lower quadrant of the abdomen	3.6	0.4	16	2	54	13
Fever	3.2	0.4	14	2	51	12
Psoas sign	3.2	0.9	14	4	52	23
Rebound tenderness	2.0	0.5	10	3	40	15
Rigidity	1.6	0.9	9	5	38	23

β-hCG = beta human chorionic gonadotropin; LR+ = positive likelihood ratio; LR- = negative likelihood ratio.

*—Probability of disease after a test is performed.

†—Probability of disease before a test is performed.

‡—LR > 1 indicates an increased likelihood of disease; LR < 1 indicates a decreased likelihood of disease. The most helpful tests generally have a ratio of < 0.2 or > 5.0.

§—Value of β-hCG at presentation for care.

Adapted with permission from Kruszka PS, Kruszka SJ. Evaluation of acute pelvic pain in women. *Am Fam Physician*. 2010;82(2):144.