

**American College of Radiology  
ACR Appropriateness Criteria®  
Left Lower Quadrant Pain**

**Variant: 1 Left lower quadrant pain. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT abdomen and pelvis with IV contrast	Usually Appropriate	☼☼☼
US abdomen transabdominal	May Be Appropriate	○
US pelvis transvaginal	May Be Appropriate	○
Radiography abdomen and pelvis	May Be Appropriate	☼☼☼
MRI abdomen and pelvis without and with IV contrast	May Be Appropriate	○
MRI abdomen and pelvis without IV contrast	May Be Appropriate	○
CT abdomen and pelvis without IV contrast	May Be Appropriate	☼☼☼
Fluoroscopy contrast enema	Usually Not Appropriate	☼☼☼
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☼☼☼☼

**Variant: 2 Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT abdomen and pelvis with IV contrast	Usually Appropriate	☼☼☼
MRI abdomen and pelvis without and with IV contrast	May Be Appropriate	○
MRI abdomen and pelvis without IV contrast	May Be Appropriate	○
CT abdomen and pelvis without IV contrast	May Be Appropriate	☼☼☼
US abdomen transabdominal	Usually Not Appropriate	○
US pelvis transvaginal	Usually Not Appropriate	○
Fluoroscopy contrast enema	Usually Not Appropriate	☼☼☼
Radiography abdomen and pelvis	Usually Not Appropriate	☼☼☼
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☼☼☼☼

**Variant: 3 Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT abdomen and pelvis with IV contrast	Usually Appropriate	☼☼☼
Fluoroscopy contrast enema	May Be Appropriate	☼☼☼
Fluoroscopy cystography	May Be Appropriate	☼☼☼
MRI abdomen and pelvis without and with IV contrast	May Be Appropriate	○
MRI abdomen and pelvis without IV contrast	May Be Appropriate	○
CT abdomen and pelvis without IV contrast	May Be Appropriate	☼☼☼
CT pelvis with bladder contrast (CT cystography)	May Be Appropriate	☼☼☼☼
US abdomen transabdominal	Usually Not Appropriate	○
US pelvis transvaginal	Usually Not Appropriate	○
Radiography abdomen and pelvis	Usually Not Appropriate	☼☼☼
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☼☼☼☼

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## Summary of Literature Review

### Introduction/Background

The differential diagnosis for left lower quadrant pain includes gastrointestinal, gynecologic, urologic, and body wall pathology. These conditions range from the benign and self-limited to life-threatening surgical emergencies. Along with patient history, physical examination, and laboratory tests, imaging is often critical to limit the differential diagnosis and identify life-threatening abnormalities [1].

Appropriate imaging triage for patients with left lower quadrant pain should address the diagnostic possibilities and consider which imaging modality can best add clinically relevant information to help guide management. In older patients, early diagnosis is important because this population has a higher rate of comorbid disease-related complications [2-6]. Furthermore, symptoms and clinical findings may be nonspecific in this population, with atypical presentation of common diseases.

Acute colonic diverticulitis is the most common explanation for left lower quadrant pain, and the prevalence is rising. There was a 50% increase in diverticulitis events between 2000 and 2007 [6,7]. Colonic diverticulitis, which results from inflammation of colonic diverticula, is common in Western populations, likely due to inadequate dietary fiber. Approximately 10% of the Western population has diverticulosis at 40 years of age; this increases to 70% or more in older patients. It has been estimated that between 5% and 25% of patients with diverticulosis will develop diverticulitis [3,8].

Although the most common cause of adult left lower quadrant pain is acute diverticulitis of the sigmoid or descending colon, other common causes of left lower quadrant pain include colitis, inflammatory bowel disease, epiploic appendagitis, bowel obstruction, hernia, ovarian and fallopian tube pathology, pyelonephritis, and urolithiasis [6,9]. Many of these conditions can present with symptoms that overlap with the acute presentation of diverticulitis.

### Special Imaging Considerations

*Diverticulitis and Colon Cancer:* Perforated colon cancer can mimic diverticulitis [10]. CT findings that suggest colon cancer rather than diverticulitis include abnormal pericolic lymph nodes (>1 cm in short axis and/or rounded) or a luminal mass [10-12]. Patients with uncomplicated diverticulitis do not have a higher risk of colon cancer than the general population [10]. The prevalence of colon cancer in patients with uncomplicated diverticulitis has been reported to be 0.5% to 0.9% [10,13,14]. Colonoscopy after a diagnosis of uncomplicated diverticulitis is not indicated in the general population. [10,15]. Colonoscopy may have a role in the following situations: 1) patients for whom colonoscopy is indicated for colon cancer screening but in whom it has not yet been

performed, 2) patients with abnormal pericolic lymph node(s), 3) patients with a luminal colon mass, and 4) patients with an uncertain diagnosis (eg, inflammatory bowel disease or ischemic colitis) [16]. Colonoscopy in general should be avoided in the setting of acute diverticulitis because of the risk of perforation; if indicated, it usually is deferred until the acute event has resolved.

*Use of Oral and Rectal Contrast Media for CT:* Neither oral nor rectal contrast is required for the routine evaluation of left lower quadrant pain. More than 20 studies have found no benefit for oral contrast in the evaluation of abdominal pain in the emergency department [17]. Rectal contrast may have a limited role in evaluating for perforation after surgical intervention.

### **Initial Imaging Definition**

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously where each procedure provides unique clinical information to effectively manage the patient's care).

### **Discussion of Procedures by Variant**

#### **Variant 1: Left lower quadrant pain. Initial imaging.**

This variant applies if there is nonspecific pain in the left lower quadrant with a broad differential diagnosis including gastrointestinal, gynecologic, urologic, and body wall pathology. If diverticulitis is primarily suspected, please refer to Variant 2 (suspected diverticulitis) or Variant 3 (suspected complication of diverticulitis).

Unless otherwise stated, the ratings and recommendations for this document specifically relate to the adult nonpregnant patient. If a gynecologic condition is primarily suspected in a woman of reproductive age, please refer to ACR Appropriateness Criteria<sup>®</sup> topic on "[Acute Pelvic Pain in the Reproductive Age Group](#)" [18].

#### **Variant 1: Left lower quadrant pain. Initial imaging.**

##### **A. CT Abdomen and Pelvis**

CT is the most useful examination for left lower quadrant pain [16,19]. It is accurate and guides appropriate management, regardless of patient sex or patient body habitus [20]. CT is sensitive for small quantities of extraluminal intraperitoneal or retroperitoneal air [21,22]. Extraluminal air can be a critical finding indicating luminal perforation and often has surgical implications. Colonic diverticulitis is a common cause of small-volume extraluminal air at CT. Large-volume extraperitoneal air is more commonly seen with peptic ulcer disease or anastomotic dehiscence but can indicate a large-caliber perforation from diverticulitis [21]. Mortality rates are higher in patients with larger amounts of extraluminal air [21].

The use of intravenous (IV) contrast material at CT can improve the characterization and detection of bowel wall pathology, pericolic abnormalities, vascular pathology, and intraabdominal fluid collections [2]. However, unenhanced CT can be accurate in the assessment of nonspecific acute abdominal pain in the emergency department [2,23,24]. In 2019, Barat et al [2] evaluated 208 consecutive patients aged 75 years or older with acute abdominal pain in the emergency department and found that the accuracy of unenhanced CT (64% [95% confidence interval (CI): 62%-66%] to 68% [66%-70%]) was similar to ( $P = .97-.98$ ) the accuracy of contrast-enhanced CT (68% [66%-70%] to 71% [69%-73%]) based on a composite standard of reference, and unenhanced CT had substantial interrater agreement ( $\kappa = 0.75-0.79$ ). Unenhanced CT is recommended for suspected urolithiasis, with sensitivity and specificity for urinary tract calculi near 100%.

#### **Variant 1: Left lower quadrant pain. Initial imaging.**

##### **B. Fluoroscopic Contrast-Enhanced Enema**

Contrast-enhanced enema is not generally useful as the initial imaging test in patients with left lower quadrant pain. Although it may hold some utility in sigmoid and small bowel pathology, contrast enema would be of little value in the work up of other potential etiologies of left lower quadrant pain including gynecologic or urologic conditions. No recent studies in the utility of fluoroscopic contrast-enhanced enema and left lower quadrant pain have been published.

#### **Variant 1: Left lower quadrant pain. Initial imaging.**

##### **C. MRI Abdomen and Pelvis**

MRI is not useful for the initial evaluation of acute abdominal pain [1,12]. It is less sensitive for extraluminal air and urinary tract calculi, is more time-consuming to perform, requires an active screening process for indwelling devices and metal, and is more subject to motion artifacts in symptomatic patients.

Few have compared the diagnostic accuracy of CT and MRI for the evaluation of left lower quadrant pain. In a 2013 pilot study, 30 consecutive patients with either sigmoid colon cancer ( $n = 15$ ) or recent treatment for acute diverticulitis ( $n = 15$ ) were imaged with CT or unenhanced MRI (T2-weighted and diffusion-weighted imaging) [12]. MRI was found to be more accurate than CT for the differentiation of cancer from diverticulitis (sensitivity: 100% versus 67%, specificity: 100% versus 93%) [12]. There are no large studies confirming the diagnostic accuracy of MRI for the general evaluation of patients with left lower quadrant pain.

#### **Variant 1: Left lower quadrant pain. Initial imaging.**

##### **D. Radiography Abdomen and Pelvis**

Radiography is not useful as the initial imaging test for the general population of patients with left lower quadrant pain because CT is more accurate. Radiography can identify large volume extraluminal air, can diagnose ileus or bowel obstruction, or may diagnose urolithiasis. CT is more sensitive and specific for each of those entities. Radiography may play a role in the triage of severely ill patients with a surgical abdomen, but CT is used in most cases.

#### **Variant 1: Left lower quadrant pain. Initial imaging.**

##### **E. US Abdomen Transabdominal**

Ultrasound (US) may be used to reduce the proportion of CT examinations performed without a deleterious effect on patient care by identifying patients with diverticulitis who do not have a surgical abdomen [4]. US is real-time and noninvasive. It can be directed to the patient's area of

maximal pain for targeted evaluation [16,20,25]. US is less common in the United States for the initial imaging of nongynecologic left lower quadrant pain [16,20].

### **Variant 1: Left lower quadrant pain. Initial imaging.**

#### **F. US Pelvis Transvaginal**

In premenopausal female patients, gynecologic and nongynecologic pathology may present with a similar clinical picture. Therefore, in this patient group, initial imaging with a pelvic US may be useful if there is clinical concern for a possible acute gynecologic cause for the left lower quadrant pain. Please note, the imaging of premenopausal women with acute pelvic pain and suspected gynecologic pathology is discussed in the ACR Appropriateness Criteria<sup>®</sup> topic on "[Acute Pelvic Pain in the Reproductive Age Group](#)" [18].

### **Variant 2: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

Diverticulitis is suspected in patients with left lower quadrant pain, fever, and leukocytosis. However, this triad is present in only approximately 25% of patients with diverticulitis [6,26]. Misdiagnosis based on clinical assessment alone has been reported to be between 34% and 68% [6,27,28].

Imaging may not be required in certain patients with typical symptoms of diverticulitis, a prior history of diverticulitis with similar symptoms, and no evidence of complication(s) [4]. Such patients may be treated medically without imaging. [6,9]. However, there has been a trend toward greater use of imaging to confirm the diagnosis of diverticulitis, evaluate the extent of disease, and detect complications before deciding on appropriate treatment [6,23]. This is due to complications such as perforation, abscess, fistula, or obstruction that may require surgery or interventional radiology management. Additionally, misdiagnosis based on clinical assessment alone is common [6,16,27,28]. Treatment depends on the severity of disease. Medical therapy is indicated for uncomplicated diverticulitis or locally perforated diverticulitis without a drainable collection. Catheter drainage is indicated for abscess(es) of sufficient size (ie,  $\geq 3$  cm), and surgery is indicated for free perforation and peritonitis [29].

### **Variant 2: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

#### **A. CT Abdomen and Pelvis**

CT is the most useful examination for patients with suspected colonic diverticulitis because of its reproducibility, superior diagnostic accuracy (98%) [16,19], accuracy for alternative diagnoses with a similar presentation [9,16], risk-stratification of patients for operative versus nonoperative treatment [8,30-32], and inpatient versus outpatient triage [33,34]. CT diagnosis of uncomplicated acute diverticulitis in the emergency department can prevent unneeded hospital admission [3,5]. This is because most colonic diverticulitis is uncomplicated and can be managed with outpatient antibiotics [11]. Juszczak et al [5] showed that early CT for acute diverticulitis can reduce hospital admission by more than 50% and shorten hospital length of stay.

IV contrast material is commonly used to improve the characterization and detection of subtle bowel wall abnormalities and complications of diverticulitis (eg, abscess) [2,29]. However, for most patients, IV or intracavitary contrast material is not necessary for the diagnosis of diverticulitis [35,36].

Unenhanced CT is more accurate than clinical evaluation alone and can be used in patients with contraindication to IV contrast material [23]. Radiation dose-reduced (50%-90% less than

"standard dose") contrast-enhanced CT can be accurate for acute diverticulitis [8,16], with a similar sensitivity and specificity to "standard dose" contrast-enhanced CT [37,38].

CT may also help predict which patients are likely to experience recurrent diverticulitis and thereby augment triage between surveillance and operative management [39]. Colonic wall thickness at the site of diverticulitis and extent of diverticulitis-related complication may predict recurrent diverticulitis. Dickerson et al [39] showed that patients with colonic wall thicknesses <9 mm had a 19% recurrence risk at 1 year compared with a 40% recurrence if the wall thickness was >15 mm.

Numerous CT classification systems for diverticulitis have been proposed but none are widely integrated into clinical practice. For example, the Hinchey classification uses CT findings to differentiate between uncomplicated and complicated disease [29,40,41]. Endoscopic classification systems for predicting occurrence, recurrence, and need for surgery are undergoing validation.

In patients requiring colonoscopy for colon cancer screening, CT colonography has been proposed as an alternative to colonoscopy [16,42].

### **Variants 2: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

#### **B. Fluoroscopic Contrast-Enhanced Enema**

Contrast-enhanced enema is not useful as the initial imaging test in patients with suspected diverticulitis because CT is more accurate and easier to obtain [16]. Because diverticulitis is mainly an extramucosal process, and contrast enema shows only the secondary effects of inflammation on the colon, the evaluation of extraluminal abnormalities, such as abscesses and pericolic fat inflammation, is limited.

Contrast-enhanced enema can be used to assess for complications of diverticulitis (eg, fistula) and for presurgical planning before colonic resection (ie, assess length of stricture and colonic motility) [16].

### **Variants 2: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

#### **C. MRI Abdomen and Pelvis**

In 2021, Jerjen et al [43] published a systematic review of the use of MRI for the diagnosis of acute colonic diverticulitis. The authors found that the diagnostic accuracy of MRI for diverticulitis is likely less than that of CT but insufficiently studied. Published estimates of diagnostic accuracy have been limited by study-related biases and small sample sizes. At present, there are insufficient published data to support the routine use of MRI for the diagnosis of suspected diverticulitis.

Findings of diverticulitis at MRI are like those at CT: colonic diverticula, thickened diverticulum(la), and inflammation in the pericolic fat, with or without complication (eg, abscess, fistula, perforation). MRI is less sensitive than CT for small-volume extraluminal gas and is more affected by patient motion than CT.

Abbreviated MR protocols are being explored to reduce acquisition time and enable emergency department evaluation for suspected diverticulitis, but this remains a research application.

### **Variants 2: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

#### **D. Radiography Abdomen and Pelvis**

Radiography is not useful as the initial imaging test for the general population of patients with

suspected diverticulitis because CT is more accurate. Radiography can identify large volume extraluminal air or bowel obstruction. CT is more sensitive and specific for both. Radiography may play a role in the triage of severely ill patients with a surgical abdomen, but CT is used in most cases.

## **Variant 2: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

### **E. US Abdomen Transabdominal**

Although US is the initial imaging test for suspected diverticulitis in some European countries and the developing world, it still is not widely used in the United States, possibly in part due to a larger obese population.

Acute diverticulitis is diagnoseable by US using the following criteria [25]:

1. Short-segment colonic wall thickening (>5 mm)
2. Inflamed diverticulum in the thickened area (hypoechoic and surrounded by hyperechoic fat)
3. Noncompressible hyperechoic pericolonic tissue

In 2019, an interdisciplinary task force of European experts recommended US as a first-line imaging modality for patients with suspected diverticulitis [25]. US was given an "A+" grade by most task force members (16-17 of 18 members) for the following statements: "US imaging should be a routine procedure in all patients with suspected diverticulitis" and "Sonography can confirm the diagnosis of acute diverticulitis and allows early risk stratification."

Meta-analyses and prospective studies have demonstrated sensitivity and positive predictive value of graded compression US for diverticulitis of >90%. The accuracy is modestly less than that of CT, but especially so in obese patients and in patients with distal sigmoid diverticulitis. US likely has lower specificity than CT and is less likely to identify an alternative diagnosis. Furthermore, US requires a higher level of training for the diagnosis of diverticulitis than does CT. Dirks et al [25] estimate that a minimum of 500 examinations is required for competency.

If used as the initial imaging test at the bedside (eg, point of care), US may hypothetically reduce the number of CT scans performed without a negative effect on patient care, with CT used in inconclusive cases or when the US is negative. US also has the benefit of being noninvasive.

## **Variant 2: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.**

### **F. US Pelvis Transvaginal**

Although pelvic US is an important imaging test in premenopausal women with suspected gynecologic abnormalities, it is generally not considered an appropriate initial imaging test for suspected diverticulitis.

The imaging of premenopausal women with acute pelvic pain is discussed in the ACR Appropriateness Criteria<sup>®</sup> topic on "[Acute Pelvic Pain in the Reproductive Age Group](#)" [18].

## **Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

## **Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

### **A. CT Abdomen and Pelvis**

CT is the most useful examination for patients with suspected complications of colonic diverticulitis because of its reproducibility, superior diagnostic accuracy [16,19], accuracy for alternative diagnoses with a similar presentation [9,16], risk-stratification of patients for operative versus nonoperative treatment [8,30-32], and inpatient versus outpatient triage [33,34].

IV and oral contrast material may improve diagnosis of abscess by distinguishing from adjacent bowel. Unenhanced CT with oral contrast is less accurate than contrast-enhanced CT with oral contrast for the characterization of complications of diverticulitis but is superior to unenhanced CT without oral contrast [32]. Combining unenhanced CT with contrast-enhanced CT (biphasic imaging) is unnecessary and not recommended [23].

CT can predict unfavorable outcomes from acute diverticulitis. Longer segments of involved colon, retroperitoneal abscess, and extraluminal air have been associated with recurrence, failure of medical management, and need for surgery. Additionally, abscess size and size of the inflamed diverticulum(la) may predict longer hospitalization [32,44,45]. Higher C-reactive protein, worse leukocytosis, and advanced age also may be associated with treatment failure [3].

CT can differentiate contained extraluminal air from abscess from spilled feces; this is important for clinical management and surgical decision-making. Small-volume pericolic air (<5 cm from affected segment) can be treated with medical therapy, whereas spilled feces generally requires surgical management [3]. Abscess(es) can be drained through percutaneous US- or CT-guided catheter placement; catheter placement can reduce the need for operative intervention [3,34]. CT- or CT-fluoroscopic guidance may be preferred over US guidance when the abscess(es) is deep or composed predominantly of air [21]. CT also can identify strictures and fistulas. Both often require surgical management and may occur in patients with recurrent or chronic diverticulitis [39,46].

**Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

**B. CT Pelvis with Bladder Contrast (CT Cystography)**

Colovesical fistula is suspected in patients with diverticulitis and concomitant urinary tract infection, fecaluria, or pneumaturia. CT cystography is not usually helpful for the initial evaluation of colovesical fistula. Colovesical fistula can usually be diagnosed at contrast-enhanced CT alone without intracavitary contrast material based on enhancing tract(s) with or without gas extending from the colon to the bladder wall, with or without associated focal bladder wall thickening [47]. CT cystography can provide additional information regarding the size and location of the colovesical fistula in presurgical planning in some cases [48].

**Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

**C. Fluoroscopy Contrast Enema**

Contrast-enhanced enema is not useful as the initial imaging test in patients with suspected diverticulitis because CT is more accurate and easier to obtain [16].

Contrast-enhanced enema can be used to assess for complications of diverticulitis (eg, fistula) and for presurgical planning before colonic resection (ie, assess length of stricture and colonic motility) [16,32]. Intracavitary contrast material commonly does not fill colovesical fistula tracts due to their small caliber and insufficient intraluminal pressure.

**Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial**

**imaging.**

#### **D. Fluoroscopy Cystography**

A fluoroscopic cystogram is uncommonly used as an initial imaging test for evaluation of suspected complications of diverticulitis. However, in the setting of potential colovesical fistula following diverticulitis, it may be considered useful in some circumstances as an additional imaging modality, for example, in the setting of preoperative planning, or if the CT findings are ambiguous, and/or based on surgeon preference [47,48].

**Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

#### **E. MRI Abdomen and Pelvis**

MRI is a second-line imaging examination for suspected complications of diverticulitis. When performed, contrast-enhanced MRI is likely more accurate than unenhanced MRI.

Small studies with risk of bias have assessed the diagnostic accuracy of MRI compared to CT. In 2021, Jerjen et al [43] published a systematic review of the use of MRI for the diagnosis of acute colonic diverticulitis. The authors found that the diagnostic accuracy of MRI for diverticulitis is likely less than that of CT but insufficiently studied. Published estimates of diagnostic accuracy have been limited by study-related biases and small sample sizes. At present, there are insufficient published data to support routine use of MRI for the diagnosis of complications of diverticulitis.

MRI is less sensitive for extraluminal gas than CT and is more affected by motion artifacts. Motion artifacts are common in severely ill patients.

**Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

#### **F. Radiography Abdomen and Pelvis**

Radiography is not useful as the initial imaging test for the general population of patients with suspected complications from diverticulitis because CT is more accurate. Radiography can identify large volume extraluminal air or bowel obstruction. CT is more sensitive and specific for both. Radiography may play a role in the triage of severely ill patients with a surgical abdomen, but CT is used in most cases.

**Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

#### **G. US Abdomen Transabdominal**

US is less accurate than CT for the diagnosis of complications related to diverticulitis. Studies have shown that US may misdiagnose up to 80% of patients with complicated diverticulitis [49,50].

US may permit differentiation of an abscess from an inflammatory mass, especially with use of US contrast [3]. In patients with known abscess(es), US enables real-time needle guidance for aspiration or catheter drainage. Choice of imaging technique for drainage is user-dependent, but US guidance in general is preferred over CT guidance for larger and more superficial collections [16,34].

**Variant 3: Left lower quadrant pain. Suspected complication(s) of diverticulitis. Initial imaging.**

#### **H. US Pelvis Transvaginal**

Transvaginal US is not useful for the diagnosis of complicated diverticulitis. It may be useful in unusual circumstances to guide abscess drainage if other routes are not available.

## Summary of Recommendations

- **Variation 1:** CT abdomen and pelvis with IV contrast is usually appropriate as the initial imaging in patients with left lower quadrant pain.
- **Variation 2:** CT abdomen and pelvis with IV contrast is usually appropriate as the initial imaging in patients with suspected diverticulitis with left lower quadrant pain.
- **Variation 3:** CT abdomen and pelvis with IV contrast is usually appropriate as the initial imaging in patients with suspected complications of diverticulitis with left lower quadrant pain.

## Supporting Documents

The evidence table, literature search, and appendix for this topic are available at <https://acsearch.acr.org/list>. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents, please go to the ACR website at <https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria>.

## Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

## Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® [Radiation Dose Assessment Introduction](#) document [51].

<b>Relative Radiation Level Designations</b>		
<b>Relative Radiation Level*</b>	<b>Adult Effective Dose Estimate Range</b>	<b>Pediatric Effective Dose Estimate Range</b>
○	0 mSv	0 mSv
☸	<0.1 mSv	<0.03 mSv
☸ ☸	0.1-1 mSv	0.03-0.3 mSv
☸ ☸ ☸	1-10 mSv	0.3-3 mSv
☸ ☸ ☸ ☸	10-30 mSv	3-10 mSv
☸ ☸ ☸ ☸ ☸	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

## References

1. Cartwright SL, Knudson MP. Diagnostic imaging of acute abdominal pain in adults. [Review]. American Family Physician. 91(7):452-9, 2015 Apr 01.
2. Barat M, Paisant A, Calame P, et al. Unenhanced CT for clinical triage of elderly patients presenting to the emergency department with acute abdominal pain. Diagn Interv Imaging. 100(11):709-719, 2019 Nov.
3. Bolkenstein HE, van Dijk ST, Consten ECJ, et al. Conservative Treatment in Diverticulitis Patients with Pericolonic Extraluminal Air and the Role of Antibiotic Treatment. J Gastrointest Surg. 23(11):2269-2276, 2019 11.
4. Caputo P, Rovagnati M, Carzaniga PL. Is it possible to limit the use of CT scanning in acute diverticular disease without compromising outcomes? A preliminary experience. Ann Ital Chir. 86(1):51-5, 2015 Jan-Feb.
5. Juszczak K, Ireland K, Thomas B, Kroon HM, Hollington P. Reduction in hospital admissions with an early computed tomography scan: results of an outpatient management protocol for uncomplicated acute diverticulitis. ANZ J Surg. 89(9):1085-1090, 2019 09.

6. Weinrich JM, Bannas P, Avanesov M, et al. MDCT in the Setting of Suspected Colonic Diverticulitis: Prevalence and Diagnostic Yield for Diverticulitis and Alternative Diagnoses. *AJR Am J Roentgenol.* 215(1):39-49, 2020 07.
7. Bharucha AE, Parthasarathy G, Ditah I, et al. Temporal Trends in the Incidence and Natural History of Diverticulitis: A Population-Based Study. *Am J Gastroenterol* 2015;110:1589-96.
8. Sartelli M, Moore FA, Ansaloni L, et al. A proposal for a CT driven classification of left colon acute diverticulitis. *World J Emerg Surg* 2015;10:3.
9. Bodmer NA, Thakrar KH. Evaluating the Patient with Left Lower Quadrant Abdominal Pain. [Review]. *Radiol Clin North Am.* 53(6):1171-88, 2015 Nov.
10. Sai VF, Velayos F, Neuhaus J, Westphalen AC. Colonoscopy after CT diagnosis of diverticulitis to exclude colon cancer: a systematic literature review. *Radiology.* 2012;263(2):383-390.
11. van Dijk ST, Daniels L, Nio CY, Somers I, van Geloven AAW, Boermeester MA. Predictive factors on CT imaging for progression of uncomplicated into complicated acute diverticulitis. *Int J Colorectal Dis.* 32(12):1693-1698, 2017 Dec.
12. Oistamo E, Hjern F, Blomqvist L, Von Heijne A, Abraham-Nordling M. Cancer and diverticulitis of the sigmoid colon. Differentiation with computed tomography versus magnetic resonance imaging: preliminary experiences. *Acta Radiol.* 2013;54(3):237-241.
13. Lahat A, Yanai H, Menachem Y, Avidan B, Bar-Meir S. The feasibility and risk of early colonoscopy in acute diverticulitis: a prospective controlled study. *Endoscopy* 2007;39:521-4.
14. Suhardja TS, Norhadi S, Seah EZ, Rodgers-Wilson S. Is early colonoscopy after CT-diagnosed diverticulitis still necessary?. *Int J Colorectal Dis.* 32(4):485-489, 2017 Apr.
15. Ou G, Rosenfeld G, Brown J, et al. Colonoscopy after CT-diagnosed acute diverticulitis: Is it really necessary?. *Can J Surg.* 58(4):226-31, 2015 Aug.
16. Stimac D, Nardone G, Mazzari A, et al. What's New in Diagnosing Diverticular Disease. *J. Gastrointestinal Liver Diseases.* 28(suppl. 4):17-22, 2019 Dec 19.
17. Kessner R, Barnes S, Halpern P, Makrin V, Blachar A. CT for Acute Nontraumatic Abdominal Pain-Is Oral Contrast Really Required?. *Acad Radiol.* 24(7):840-845, 2017 07.
18. American College of Radiology. ACR Appropriateness Criteria®: Acute Pelvic Pain in the Reproductive Age Group. Available at: <https://acsearch.acr.org/docs/69503/Narrative/>.
19. Fukata K, Takamizawa J, Miyake H, et al. Diagnosis of appendiceal diverticulitis by multidetector computed tomography. *Jpn J Radiol.* 38(6):572-578, 2020 Jun.
20. van Randen A, Lameris W, van Es HW, et al. A comparison of the accuracy of ultrasound and computed tomography in common diagnoses causing acute abdominal pain. *Eur Radiol.* 2011;21(7):1535-1545.
21. Faggian A, Berritto D, Iacobellis F, Reginelli A, Cappabianca S, Grassi R. Imaging Patients With Alimentary Tract Perforation: Literature Review. [Review]. *Seminars in Ultrasound, CT & MR.* 37(1):66-9, 2016 Feb. *Semin Ultrasound CT MR.* 37(1):66-9, 2016 Feb.
22. Tau N, Cohen I, Barash Y, Klang E. Free abdominal gas on computed tomography in the emergency department: aetiologies and association between amount of free gas and

mortality. *Ann R Coll Surg Engl.* 102(8):581-589, 2020 Oct.

23. Millet I, Sebbane M, Molinari N, et al. Systematic unenhanced CT for acute abdominal symptoms in the elderly patients improves both emergency department diagnosis and prompt clinical management. *European Radiology.* 27(2):868-877, 2017 Feb. *Eur Radiol.* 27(2):868-877, 2017 Feb.
24. Sala E, Watson CJ, Beadsmoore C, et al. A randomized, controlled trial of routine early abdominal computed tomography in patients presenting with non-specific acute abdominal pain. *Clin Radiol.* 2007;62(10):961-969.
25. Dirks K, Calabrese E, Dietrich CF, et al. EFSUMB Position Paper: Recommendations for Gastrointestinal Ultrasound (GIUS) in Acute Appendicitis and Diverticulitis. [Review]. *Ultraschall in der Medizin.* 40(2):163-175, 2019 Apr. *Ultraschall Med.* 40(2):163-175, 2019 Apr.
26. Etzioni DA, Mack TM, Beart RW, Jr., Kaiser AM. Diverticulitis in the United States: 1998-2005: changing patterns of disease and treatment. *Ann Surg* 2009;249:210-7.
27. Andeweg CS, Knobben L, Hendriks JC, Bleichrodt RP, van Goor H. How to diagnose acute left-sided colonic diverticulitis: proposal for a clinical scoring system. *Ann Surg.* 2011;253(5):940-946.
28. Tursi A, Brandimarte G, Di Mario F, et al. Predictive value of the Diverticular Inflammation and Complication Assessment (DICA) endoscopic classification on the outcome of diverticular disease of the colon: An international study. *United European Gastroenterol J* 2016;4:604-13.
29. La Torre M, Mingoli A, Brachini G, et al. Differences between computed tomography and surgical findings in acute complicated diverticulitis. *ASIAN J. SURG.* 43(3):476-481, 2020 Mar.
30. Bates DDB, Fernandez MB, Ponchiardi C, et al. Surgical management in acute diverticulitis and its association with multi-detector CT, modified Hinchey classification, and clinical parameters. *Abdominal Radiology.* 43(8):2060-2065, 2018 08. *Abdom Radiol.* 43(8):2060-2065, 2018 08.
31. Ebersole J, Medvecz AJ, Connolly C, et al. Comparison of American Association for the Surgery of Trauma grading scale with modified Hinchey classification in acute colonic diverticulitis: A pilot study. *J Trauma Acute Care Surg.* 88(6):770-775, 2020 06.
32. Kim DH, Kim HJ, Jang SK, Yeon JW, Shin KS. CT Predictors of Unfavorable Clinical Outcomes of Acute Right Colonic Diverticulitis. *AJR Am J Roentgenol.* 209(6):1263-1271, 2017 Dec.
33. Buchs NC, Konrad-Mugnier B, Jannot AS, Poletti PA, Ambrosetti P, Gervaz P. Assessment of recurrence and complications following uncomplicated diverticulitis. *Br J Surg.* 100(7):976-9; discussion 979, 2013 Jun.
34. Gielens MP, Mulder IM, van der Harst E, et al. Preoperative staging of perforated diverticulitis by computed tomography scanning. *Tech Coloproctol.* 2012;16(5):363-368.
35. Hill BC, Johnson SC, Owens EK, Gerber JL, Senagore AJ. CT scan for suspected acute abdominal process: impact of combinations of IV, oral, and rectal contrast. *World J Surg.* 2010;34(4):699-703.
36. Rao PM, Rhea JT, Novelline RA, et al. Helical CT with only colonic contrast material for

diagnosing diverticulitis: prospective evaluation of 150 patients. *AJR Am J Roentgenol.* 1998;170(6):1445-1449.

37. Laqmani A, Veldhoen S, Dulz S, et al. Reduced-dose abdominopelvic CT using hybrid iterative reconstruction in suspected left-sided colonic diverticulitis. *Eur Radiol.* 26(1):216-24, 2016 Jan.
38. Walter SS, Maurer M, Storz C, et al. Effects of Radiation Dose Reduction on Diagnostic Accuracy of Abdominal CT in Young Adults with Suspected Acute Diverticulitis: A Retrospective Intraindividual Analysis. *Acad Radiol.* 26(6):782-790, 2019 06.
39. Dickerson EC, Chong ST, Ellis JH, et al. Recurrence of Colonic Diverticulitis: Identifying Predictive CT Findings-Retrospective Cohort Study. *Radiology.* 285(3):850-858, 2017 12.
40. Hinchey EJ, Schaaf PG, Richards GK. Treatment of perforated diverticular disease of the colon. *Adv Surg* 1978;12:85-109.
41. Schreyer A, Layer G. German Society of Digestive and Metabolic Diseases (DGVS) as well as the German Society of General and Visceral Surgery (DGAV) in collaboration with the German Radiology Society (DRG). S2k guidelines for diverticular disease and diverticulitis: diagnosis, classification, and therapy for the radiologist. *Rofo* 2015;187:676-84.
42. Flor N, Maconi G, Sardanelli F, et al. Prognostic Value of the Diverticular Disease Severity Score Based on CT Colonography: Follow-up in Patients Recovering from Acute Diverticulitis. *Acad Radiol.* 22(12):1503-9, 2015 Dec.
43. Jerjen F, Zaidi T, Chan S, et al. Magnetic Resonance Imaging for the diagnosis and management of acute colonic diverticulitis: a review of current and future use. *J Med Radiat Sci* 2021;68:310-19.
44. Hall JF, Roberts PL, Ricciardi R, et al. Long-term follow-up after an initial episode of diverticulitis: what are the predictors of recurrence? *Dis Colon Rectum* 2011;54:283-8.
45. Poletti PA, Platon A, Rutschmann O, et al. Acute left colonic diverticulitis: can CT findings be used to predict recurrence? *AJR Am J Roentgenol* 2004;182:1159-65.
46. Ambrosetti P, Becker C, Terrier F. Colonic diverticulitis: impact of imaging on surgical management -- a prospective study of 542 patients. *Eur Radiol* 2002;12:1145-9.
47. Najjar SF, Jamal MK, Savas JF, Miller TA. The spectrum of colovesical fistula and diagnostic paradigm. *Am J Surg.* 188(5):617-21, 2004 Nov.
48. Miyaso H, Iwakawa K, Hamada Y, et al. Ten Cases of Colovesical Fistula due to Sigmoid Diverticulitis. *Hiroshima Journal of Medical Sciences.* 64(1-2):9-13, 2015 Jun. *Hiroshima J Med Sci.* 64(1-2):9-13, 2015 Jun.
49. Nielsen K, Richir MC, Stolk TT, et al. The limited role of ultrasound in the diagnostic process of colonic diverticulitis. *World J Surg.* 38(7):1814-8, 2014 Jul.
50. Macia-Suarez D. Is it useful ultrasonography as the first-line imaging technique in patients with suspected acute diverticulitis?. [Review]. *RADIOLOGIA.* 61(6):506-509, 2019 Nov - Dec.
51. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: <https://edge.sitecorecloud.io/americancoldf5f-acrorgf92a-productioncb02-3650/media/ACR/Files/Clinical/Appropriateness-Criteria/ACR-Appropriateness-Criteria-Radiation-Dose-Assessment-Introduction.pdf>.

## Disclaimer

The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

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