

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

Variant 1: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.

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

Variant 2: Left lower quadrant pain. Suspected complications of diverticulitis.

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

LEFT LOWER QUADRANT PAIN-SUSPECTED DIVERTICULITIS

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Summary of Literature Review

Introduction/Background

The most common cause of left lower quadrant pain in adults is acute sigmoid or descending colonic diverticulitis. It has been estimated that between 10% and 25% of patients with diverticulosis will ultimately develop diverticulitis [1,2]. Appropriate imaging triage for patients with suspected diverticulitis (ie, left lower quadrant pain) should address the differential diagnostic possibilities and what information is necessary to make a definitive management decision. Some patients with acute diverticulitis may not require any imaging, notably those with typical symptoms of diverticulitis without suspected complications or those with a previous history of diverticulitis who present with clinical symptoms of recurrent disease [3]. In a few instances, such patients are treated medically without undergoing radiologic examinations, but diverticulitis can be simulated by other acute abdominal disorders [4]. Patients with diverticulitis may require surgery or interventional radiology procedures because of associated complications, including abscesses, fistulas, obstruction, or perforation. As a result, 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 [5,6]. Additionally, in the era of bundled payments and minimizing healthcare costs, patients with acute diverticulitis are being managed on an outpatient basis, and rapid diagnostic imaging at the time of initial symptoms helps to streamline and triage patients to the appropriate treatment pathway [7-9].

Abdominal radiography is of limited value in evaluating diverticulitis unless complications, such as free perforation (pneumoperitoneum) or obstruction, are suspected. Nuclear medicine imaging has no role in the evaluation of left lower quadrant pain. The role of MRI has not been adequately evaluated, but preliminary data suggest that it may have diagnostic potential in patients with suspected diverticulitis [10-15]. The imaging examination most widely used for diagnosing diverticulitis is CT, but ultrasound (US) (including graded-compression US), barium enema, and MRI have also been used.

Special Imaging Considerations

Diverticulitis and Colon Cancer

It should be recognized that perforated colon cancer can mimic both the clinical and radiographic findings of diverticulitis. CT findings that suggest colon cancer rather than diverticulitis include the presence of pericolic lymphadenopathy (measuring >1 cm in short axis) with or without pericolic edema. When there are inflammatory changes, edema in the root of the sigmoid mesentery, and no pericolic lymphadenopathy adjacent to a segment of thickened colon wall, the most likely diagnosis is diverticulitis [16]. For patients in whom diverticulitis is diagnosed on CT, their risk of colon cancer more closely approximates the risk of an asymptomatic patient (eg, screening colonoscopy) rather than a symptomatic patient (eg, diagnostic colonoscopy). Thus, routine colonoscopy after a CT diagnosis of acute left-sided diverticulitis may not be warranted, with the

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exception of age-appropriate and clinically indicated colon cancer screening [17-19]. The literature suggests that the likelihood of occurrence of colon cancer is higher when an abscess, local perforation, or fistula is identified [16]. For patients with findings suspicious for colon cancer on CT, colonoscopy is the preferred examination owing to its ability to detect potential masses and obtain tissue for definitive diagnosis [20]. Alternatively, CT colonography can be considered in the noninvasive evaluation for colon cancer in patients [21-24]. In the future, less invasive examinations may become clinically applicable, including quantitative CT perfusion studies [25], diffusion-weighted MRI, and MR colonography [14,26].

Use of Oral and Rectal Contrast Media for CT

A retrospective review of 661 patients found no significant difference in the ability to correctly diagnose a suspected acute abdominal process (including 199 cases of infectious/inflammatory findings) when CT imaging with oral contrast was compared with CT imaging performed without oral contrast [27]. Another study of 348 consecutive patients who presented to the emergency department for nontraumatic abdominal pain found no significant diagnostic benefit of oral contrast [28]. Although oral contrast practices for abdominal and pelvic CT vary nationally, rectal contrast is rarely used [29]. Rectal contrast may have a limited role in evaluating for perforation or for leak after surgical intervention. One study found the presence of perianastomotic air to be a reliable marker of anastomotic leaks at multidetector CT, and leakage of rectal contrast was highly accurate and increased confidence of diagnosis in evaluating colonic staple line leaks [30].

Choice of Contrast Agent during Contrast Enema

The choice of contrast agents used during contrast enema should take into account the clinical situation and be tailored to the individual examination. For patients with diverticulitis and suspected perforation, use of a water-soluble iodinated contrast agent is preferred to avoid the risk of barium spillage into the peritoneum and subsequent barium peritonitis. A water-soluble contrast agent may also be preferred if there is a high probability the patient will undergo surgical management. Water-soluble agents generally result in less beam hardening artifact and no delay in performing a subsequent abdominal pelvic CT scan. Barium contrast usually results in significant streak artifact limiting the utility of abdominal pelvic CT until the contrast is cleared from the colon. For evaluation of colonic mucosal detail, air contrast barium enema is superior to water-soluble contrast enema or single-column barium enema. A single-column barium enema can demonstrate larger luminal abnormalities and may be appropriate in patients who cannot tolerate an air contrast barium examination.

Discussion of Procedures by Variant

The rated appropriateness category of an imaging modality is the appropriateness of the examination as the initial imaging of the clinical workup. It does not necessarily reflect the appropriateness of use when considering the next examination after other initial imaging. The appropriateness reflects the ability of the imaging modality to establish the primary diagnosis for the clinical variant (ie, diverticulitis). In addition, if an imaging modality is useful to help assess for alternative diagnoses in the clinical scenario, it may impact the overall appropriateness of that examination despite an inability to primarily diagnose diverticulitis.

Variant 1: Left lower quadrant pain. Suspected diverticulitis. Initial imaging.

CT Abdomen and Pelvis

CT is currently used as the imaging examination of choice for evaluating patients with suspected descending or sigmoid colon diverticulitis because of its high sensitivity and specificity and its ability to demonstrate other causes of left lower quadrant pain that mimic diverticulitis [13,17,27]. It is reproducible and has a reported overall accuracy of 98% [31]. The value of CT imaging goes beyond diagnosis. Severity of disease on CT aids in treatment planning, with certain CT imaging features stratifying patients for operative versus nonoperative treatment [32,33]. Additionally, CT can suggest alternative diagnoses that have a similar clinical presentation [4,31,34-36]. The imaging of premenopausal women with acute pelvic pain is discussed in the ACR Appropriateness Criteria[®] topic on "[Acute Pelvic Pain in the Reproductive Age Group](#)" [37].

A variety of contrast media have been used for CT to optimize the sensitivity and specificity of the examination, including oral and intravenous (IV) contrast agents, rectally administered contrast, or air. Regardless of the technique used, the accuracy is high for depicting findings of acute diverticulitis [27,38]. CT with IV contrast improves the characterization and detection of subtle bowel wall abnormalities and complications, such as diverticular abscess [39]. Imaging with CT with IV contrast at initial assessment for suspected left colonic diverticulitis would provide the most comprehensive assessment of the disease process and aid in stratifying patients for appropriate therapy. The choice of IV contrast for follow-up imaging may depend on initial imaging

findings and the clinical course. Low-dose CT techniques can achieve radiation dose reduction between 75% to 90% compared with that of standard-dose abdominal multidetector row CT with similar sensitivity and specificity [40-42].

MRI Abdomen and Pelvis

The role of MRI in the setting of left lower quadrant pain has been evaluated, and preliminary data suggest that it may have diagnostic potential in patients with suspected diverticulitis, with reported sensitivity of 86% to 94% and specificity of 88% to 92% [10-15]. The findings for MRI are similar to those for CT, including demonstration of complications of diverticulitis, although extraluminal air may be difficult to appreciate on MRI [12,43]. Administration of IV gadolinium-based contrast may aid in the detection of inflammation and abscess formation [44]. Additionally, MRI may provide further clinical information when there is concern for an underlying colonic neoplasm in the setting of acute diverticulitis [14,26]. Motion may limit image quality in acutely ill patients unable to tolerate lying still for the duration of MRI acquisition.

Radiography Abdomen and Pelvis

Abdominal radiography is extremely limited in the evaluation of suspected diverticulitis. Abdominal radiography can demonstrate large amounts of retroperitoneal or intraperitoneal air but is significantly less sensitive for small amounts of air than CT. In the setting of intra-abdominal abscess or colovesical fistula, an abdominal radiograph may demonstrate an air-fluid level within the collection or urinary bladder but will often require a more detailed evaluation with an additional imaging modality.

Fluoroscopy Contrast Enema

In the past, contrast enema was the primary imaging examination for diverticulitis, but it has been supplanted by CT. Diverticulitis is mainly an extramucosal process, and contrast enema shows only the secondary effects of inflammation on the colon. Barium contrast enema will not show extraluminal abnormalities, such as abscesses and pericolonic inflammation [13]. Contrast enema is also more invasive and is not as sensitive for extracolonic pathology. Additionally, in the setting of acute diverticulitis, colonic distention (either by colonoscopy or air-contrast technique) increases the risk of colonic perforation [17]. Therefore, contrast enema is not recommended for the initial imaging test in patients with left lower quadrant pain and suspected diverticulitis. However, contrast enema may play a role in the follow-up of these patients or for interrogation for potential diverticulitis-related complications.

US Abdomen Transabdominal

Although most of the reported experience has been with CT, some authors advocate transabdominal US as an alternate technique for evaluating patients with suspected diverticulitis. However, there is considerable variation in the literature regarding the performance of US for the diagnosis of acute diverticulitis. Graded-compression sonography is reported to have a sensitivity of 77% to 98% and a specificity of 80% to 99% in diagnosing diverticulitis [45,46]. A meta-analysis suggested that graded-compression sonography and CT are both effective initial diagnostic tools but that CT is more likely to reveal alternative diagnoses for left lower quadrant pain, with sensitivity for alternate diagnoses ranging between 33% and 78% for US and between 50% and 100% for CT [47]. In a direct comparison of CT to US, one study reported a sensitivity of CT in detecting diverticulitis to be significantly higher than that of US: 81% versus 61% ($P = .048$), with CT missing fewer cases than US [48]. Although US could potentially provide equivalent diagnostic information when compared to CT, it is currently not widely used in the United States [45,47,49]. An important consideration is that US is much more dependent on body habitus than CT or MRI, which remains a significant issue given the ongoing obesity epidemic in the United States.

US Pelvis Transvaginal

Pelvic US remains an important diagnostic tool in certain patient populations. Transvaginal US is of particular value when left lower quadrant pain and fever occurs in women of childbearing age. In this setting, gynecologic processes, such as ectopic pregnancy and pelvic inflammatory disease, are also important diagnostic considerations. Therefore, US is the preferred choice for the initial imaging of this patient population when gynecologic pathology is suspected. CT may be used when US is equivocal, when a nongynecologic etiology is suspected to be the cause of low abdominal pain, or when a global view of a gynecologic disease process is needed [4,50].

Variant 2: Left lower quadrant pain. Suspected complications of diverticulitis.

CT Abdomen and Pelvis

CT has a major role in depicting extracolonic disease extent. By revealing the presence and extent of abscess formation, CT facilitates selection of patients for medical rather than surgical therapy, and determines if hospitalization is required [7,9,51-55]. One prospective study reported that contained perforation or abscess formation were detected with an accuracy of 96% (sensitivity 100%, specificity 91%) and 98% (sensitivity 100%, specificity 97%), respectively [31].

The use of IV and oral contrast may aid in delineation of abscesses. CT without IV contrast is less effective in delineating structures but can still be helpful for complications such as abscess. The addition of noncontrast CT to contrast CT (CT without and with IV contrast) adds little diagnostic value and is not routinely recommended. Prior to abdominal abscess drainage, imaging with administration of IV and enteric contrast may minimize the risk of nontarget catheter placement [56,57]. When abscesses are present, it has been shown that US-guided and CT-guided percutaneous drainage of abscess collections can eliminate multistage operative procedures and, in some cases, can eliminate the need for surgery entirely [53,55,58]. CT or CT fluoroscopy is also advantageous for guiding abscess drainage, particularly in cases in which collections are small and deep, in close proximity to vital structures, and located in regions that are difficult to access [57,59]. CT is also more sensitive for the detection of small volumes of free intraperitoneal or retroperitoneal air [59].

CT of the pelvis may have a role in image-guided abscess drainage and follow-up in cases of known disease limited to the pelvis. It has been shown that US-guided and CT-guided percutaneous drainage of abscess collections can eliminate multistage operative procedures and, in some cases, can eliminate the need for surgery entirely [53,55,58].

MRI Abdomen and Pelvis

The role of MRI in the setting of left lower quadrant pain has been evaluated, and preliminary data suggest that it may have diagnostic potential in patients with suspected diverticulitis, with reported sensitivity of 86% to 94% and specificity of 88% to 92% [10-15]. The findings for MRI are similar to those for CT, including demonstration of complications of diverticulitis, although extraluminal air may be a subtle finding on MRI [12,43]. Administration of IV gadolinium-based contrast may aid in the detection of inflammation and abscess formation [44]. Additionally, MRI may provide additional clinical information when there is concern for an underlying colonic neoplasm in the setting of acute diverticulitis [14,26]. For patients with documented allergies to iodinated contrast or impaired renal function, MRI with gadolinium-based contrast provides a comparable evaluation of potential complications of diverticulitis compared to contrast-enhanced CT. CT acquisition is much faster and more suitable for diagnostic imaging of an acutely ill patient who may be unable to lie still for the duration of MR image acquisition.

Radiography Abdomen and Pelvis

Abdominal radiography is extremely limited in the evaluation of suspected complications of diverticulitis. Abdominal radiography can demonstrate large amounts of retroperitoneal or intraperitoneal air but is significantly less sensitive than CT for small amounts of air. In the setting of intra-abdominal abscess or colovesical fistula, an abdominal radiograph may demonstrate an air-fluid level within the collection or urinary bladder but will often lead to more detailed evaluation with an additional imaging modality.

Fluoroscopy Contrast Enema

Although CT has replaced the contrast enema as the initial imaging examination for diverticulitis, contrast enema may be helpful in some instances as a follow-up study for evaluation for suspected fistula, stricture, or for surgical planning after treatment [60]. Contrast enema is less sensitive for extracolonic complications, including abscesses, when compared to CT [13]. Contrast enema may provide information in the long-term follow-up of patients with acute diverticulitis, such as assessment for postinflammatory colonic strictures.

CT Pelvis with Bladder Contrast (CT Cystography)

CT cystography provides many of the same benefits of routine CT for the detection of complications of acute diverticulitis with the added advantage of being able to evaluate for colovesical fistula formation. For patients who present with symptoms of urinary tract infection, fecaluria, or pneumaturia, CT cystography can accurately detect and characterize the colovesical fistula in greater than 80% of patients [60,61]. CT cystography can provide the surgeon key information regarding the size and location of the colovesical fistula for preoperative planning.

Fluoroscopy Cystography

A fluoroscopic cystogram is an alternative imaging modality for evaluation of potential colovesical fistula following diverticulitis [62,63]. While CT cystography allows for anatomic detail and 3-D depiction of the pelvic anatomy, a cystogram provides a dynamic evaluation of the urinary bladder and provides greater spatial resolution.

US Abdomen Transabdominal

Although some studies demonstrate that US is comparable in accuracy to CT for the diagnosis of uncomplicated acute diverticulitis, others suggest that US misdiagnosed 17% of patients with uncomplicated diverticulitis and 79% of patients with complicated diverticulitis [64]. An inherent disadvantage is the inability of US to penetrate extensive overlying soft tissue or air-filled structures [57]. US allows for real-time visualization of the fluid collection and potential differentiation of abscess from phlegmon, which is often treated medically without percutaneous drainage [65]. Some research suggests that contrast-enhanced US may aid in the differentiation between abscess and phlegmon [66].

US guidance for abscess drainage may be utilized for larger and more superficial collections and provides the best real-time visualization of direct needle advancement, septations, loculations, and adjacent vascular structures [65]. Additionally, US-guided abscess drainage can also be combined with fluoroscopic evaluation following the administration of iodinated contrast into the abscess (eg, an abscessogram) to evaluate for communication between the abscess and adjacent colon [65].

US Pelvis Transvaginal

While some studies demonstrate that US is comparable in accuracy to CT for the diagnosis of uncomplicated acute diverticulitis, others suggest that US misdiagnosed 17% of patients with uncomplicated diverticulitis and 79% of patients with complicated diverticulitis [64]. An inherent disadvantage is the inability of US to penetrate extensive overlying soft tissue or air-filled structures [57]. US allows for real-time visualization of the fluid collection and potential differentiation of abscess from phlegmon, which is often treated medically without percutaneous drainage [65]. Some research suggests that contrast-enhanced US may aid in the differentiation between abscess and phlegmon [66].

US guidance for abscess drainage may be appropriate for larger and more superficial collections and provides the best visualization of direct needle advancement, septations, loculations, and adjacent vascular structures [65]. It has been shown that US-guided and CT-guided percutaneous drainage of abscess collections can eliminate multistage operative procedures and, in some cases, eliminate the need for surgery entirely [53,55,58].

Summary of Recommendations

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

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 go to www.acr.org/ac.

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 [67].

Relative Radiation Level Designations		
Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
○	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".

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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.