

**American College of Radiology
ACR Appropriateness Criteria®**

Clinical Condition: Left Lower Quadrant Pain

Variant 1: Older patient with typical clinical presentation for diverticulitis.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	8	Oral and/or colonic contrast may be helpful for bowel luminal visualization.	☼ ☼ ☼ ☼
CT abdomen and pelvis without contrast	6		☼ ☼ ☼ ☼
X-ray contrast enema	5		☼ ☼ ☼
US abdomen transabdominal graded compression	4		O
US abdomen transrectal or transvaginal	4		O
X-ray abdomen and pelvis	4		☼ ☼ ☼
MRI abdomen and pelvis with or without contrast	4	See statement regarding contrast in text under "Anticipated Exceptions."	O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 2: Acute, severe, with or without fever.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	9	Oral and/or colonic contrast may be helpful for bowel luminal visualization.	☼ ☼ ☼ ☼
CT abdomen and pelvis without contrast	6		☼ ☼ ☼ ☼
X-ray abdomen and pelvis	5		☼ ☼ ☼
US abdomen transabdominal graded compression	4		O
X-ray contrast enema	4		☼ ☼ ☼
US abdomen transrectal or transvaginal	4		O
MRI abdomen and pelvis with or without contrast	3		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Clinical Condition:**Left Lower Quadrant Pain****Variant 3:****Chronic, intermittent, or low grade.**

Radiologic Procedure	Rating	Comments	<u>RRL*</u>
CT abdomen and pelvis with contrast	8	Oral and/or colonic contrast may be helpful for bowel luminal visualization.	☼☼☼☼
X-ray contrast enema	6		☼☼☼
X-ray abdomen and pelvis	5		☼☼☼
US abdomen transabdominal graded compression	5		○
CT abdomen and pelvis without contrast	5		☼☼☼☼
US abdomen transrectal or transvaginal	4		○
MRI abdomen and pelvis with or without contrast	4	See statement regarding contrast in text under “Anticipated Exceptions.”	○
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 4:**Woman of childbearing age.**

Radiologic Procedure	Rating	Comments	<u>RRL*</u>
US abdomen transabdominal graded compression	8	Could be done first to exclude gynecologic abnormality.	○
US abdomen transrectal or transvaginal	8	Could be done first to exclude gynecologic abnormality.	○
CT abdomen and pelvis with contrast	7	Oral and/or colonic contrast may be helpful for bowel luminal visualization.	☼☼☼☼
X-ray contrast enema	6		☼☼☼
CT abdomen and pelvis without contrast	5		☼☼☼☼
X-ray abdomen and pelvis	5		☼☼☼
MRI abdomen and pelvis with or without contrast	5	See statement regarding contrast in text under “Anticipated Exceptions.”	○
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 5:**Obese patient.**

Radiologic Procedure	Rating	Comments	<u>RRL*</u>
CT abdomen and pelvis with contrast	8	Oral and/or colonic contrast may be helpful for bowel luminal visualization.	☼☼☼☼
X-ray contrast enema	5		☼☼☼
CT abdomen and pelvis without contrast	5		☼☼☼☼
X-ray abdomen and pelvis	5		☼☼☼
US abdomen transabdominal graded compression	4		○
US abdomen transrectal or transvaginal	4		○
MRI abdomen and pelvis with or without contrast	4	See statement regarding contrast in text under “Anticipated Exceptions.”	○
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

LEFT LOWER QUADRANT PAIN

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Summary of Literature Review

The most common cause of left lower quadrant pain in adults is acute sigmoid diverticulitis, which is estimated to occur in 20%-25% of patients with diverticulosis. Appropriate imaging triage for patients with suspected diverticulitis (ie, left lower quadrant pain) should address two major clinical questions: 1) what are the differential diagnostic possibilities in this clinical situation and 2) 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 (eg, left lower quadrant pain and tenderness, fever) or those with a previous history of diverticulitis who present with clinical symptoms of recurrent disease. Many such patients are treated medically without undergoing radiologic examinations, but diverticulitis can be simulated by other acute abdominal disorders. Furthermore, 15%-30% of patients with diverticulitis require surgery because of associated abscesses, fistulas, obstruction, or perforation. As a result, there has been a trend toward greater use of radiologic imaging tests to confirm the diagnosis of diverticulitis, evaluate the extent of disease, and detect complications before treatment.

Abdominal radiography is of limited value in evaluating diverticulitis unless complications such as free perforation (pneumoperitoneum) or obstruction are suspected. Nuclear medicine imaging appears to have little role in the evaluation of left lower quadrant pain. The role of magnetic resonance imaging (MRI) has not been adequately evaluated, but preliminary data suggest that it may have diagnostic potential in patients with suspected

diverticulitis [1-4]. The two imaging tests most often used for diagnosing diverticulitis are the contrast enema and computed tomography (CT), but graded compression sonography has also been used.

Barium Enema

In the past, the contrast enema was the primary imaging test for diverticulitis. Some authors were reluctant to perform contrast enemas during an acute episode of diverticulitis because of concern about colonic perforation. Others recommended the use of water-soluble contrast media to avoid contaminating the peritoneal cavity with barium if perforation has occurred. However, many studies have shown that single-contrast or even double-contrast barium enemas can be safely performed during the acute episode if there are no clinical signs of perforation. The barium enema has a reported sensitivity of 59%-90% in diagnosing sigmoid diverticulitis [5-9]. It can also be used to detect other colonic diseases (eg, ischemic colitis, inflammatory bowel disease) that cause similar symptomology [5]. The examination, however, is limited, as diverticulitis is mainly an extramucosal process and barium enema only shows the secondary effects of inflammation on the colon [10]. Barium enema is more invasive and is not as sensitive for pericolic inflammation, abscesses, and distant pathology. Although CT has replaced the contrast enema as the initial imaging test for diverticulitis in most patients, the contrast enema may be helpful as a follow-up study for patients in whom the CT findings cannot unequivocally differentiate diverticulitis from colonic carcinoma.

Computed Tomography

CT is now widely advocated as the imaging test of choice for evaluating patients with suspected sigmoid diverticulitis because of its high sensitivity and specificity and its ability to diagnose other causes of left lower quadrant pain that mimic diverticulitis. It is widely available, reproducible, and less invasive than the contrast enema, and it has a reported sensitivity of 79%-99% [6-9,11]. CT also has a major role in determining disease extent; this assessment is rarely possible with contrast enema. By assessing the presence and extent of abscess formation, CT facilitates selection of patients for medical versus surgical therapy [6-9,11-13]. When abscesses are present, it has been shown that CT-guided percutaneous drainage of abscess collections can eliminate multistage operative procedures and, in some cases, can eliminate the need for surgery entirely [12-15]. Finally, CT can demonstrate extracolonic diseases (eg, genitourinary and gynecologic abnormalities) that have a similar clinical presentation.

A variety of contrast media have been used for CT to optimize the sensitivity and specificity of the examination, including oral and intravenous contrast agents and rectally administered contrast or air. Many authors advocate the use of rectal contrast material to

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improve colonic distention and increase the accuracy of the examination for detecting diverticulitis [16].

Ultrasound

Although most of the reported experience has been with CT, transabdominal sonography has been advocated as an alternative technique for evaluating patients with suspected diverticulitis [17-19]. Graded compression sonography is reported to have a sensitivity of 77%-98% and a specificity of 80%-99% in diagnosing diverticulitis [17,18,20]. Some investigators advocate the selective use of transrectal sonography to improve detection of diverticulitis if the findings on transabdominal sonography are negative or equivocal [21]. Transvaginal sonography is particularly of value when left lower quadrant pain and fever occur in women of childbearing age. In this setting, gynecologic processes such as ectopic pregnancy and pelvic inflammatory disease are also important diagnostic considerations. Sonography is therefore an excellent choice for the initial imaging of this patient population, because it is more sensitive than CT or contrast enemas in detecting gynecologic abnormalities that cause left lower quadrant pain. However, graded compression sonography is a technique that is highly operator dependent and ultrasound for diverticulitis is not widely used. MRI can also be effective for diagnosing diverticulitis and has the advantage of lack of radiation, but generally CT is used [2,3].

Finally, it should be recognized that a perforated colon cancer can mimic both the clinical and radiographic findings of diverticulitis. CT findings that suggest colon cancer over diverticulitis include the presence of pericolonic lymphadenopathy (1 cm), with or without pericolonic edema. When there are inflammatory changes and no pericolonic lymphadenopathy adjacent to a segment of thickened colon wall, the most likely diagnosis is diverticulitis [22-24]. Patients with equivocal CT findings of diverticulitis should undergo a follow-up examination of the colonic mucosa after the acute symptoms have resolved. Either a colonoscopy or barium enema could be performed to differentiate diverticulitis from a perforated colon cancer in these patients. Quantitative CT perfusion measurements have been shown to differentiate cancer from diverticulitis. Patients with cancer have the highest blood volume, blood flow, and permeability and the shortest transit time [25].

Summary

CT is now widely advocated as the primary imaging test for evaluating acute sigmoid diverticulitis because of its high sensitivity and specificity, its ability to determine the presence and extent of disease that might warrant percutaneous catheter drainage or surgery, and its ability to demonstrate extracolonic disease in these patients.

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the

administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (ie, <30 mL/min/1.73m²), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73m². For more information, please see the [ACR Manual on Contrast Media](#) [26].

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, both because of 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 to 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.

Relative Radiation Level Designations		
Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	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 NS (not specified).		

Supporting Document(s)

- [ACR Appropriateness Criteria® Overview](#)
- [Procedure Contrast Information](#)
- [Evidence Table](#)

References

1. Ajaj W, Ruehm SG, Lauenstein T, et al. Dark-lumen magnetic resonance colonography in patients with suspected sigmoid diverticulitis: a feasibility study. *Eur Radiol* 2005; 15(11):2316-2322.
2. Buckley O, Geoghegan T, McAuley G, Persaud T, Khosa F, Torreggiani WC. Pictorial review: magnetic resonance imaging of colonic diverticulitis. *Eur Radiol* 2007; 17(1):221-227.
3. Heverhagen JT, Zielke A, Ishaque N, Bohrer T, El-Sheik M, Klose KJ. Acute colonic diverticulitis: visualization in magnetic resonance imaging. *Magn Reson Imaging* 2001; 19(10):1275-1277.
4. Schreyer AG, Furst A, Agha A, et al. Magnetic resonance imaging based colonography for diagnosis and assessment of diverticulosis and diverticulitis. *Int J Colorectal Dis* 2004; 19(5):474-480.
5. Balthazar EJ, Megibow A, Schinella RA, Gordon R. Limitations in the CT diagnosis of acute diverticulitis: comparison of CT, contrast enema, and pathologic findings in 16 patients. *AJR* 1990; 154(2):281-285.
6. Cho KC, Morehouse HT, Alterman DD, Thornhill BA. Sigmoid diverticulitis: diagnostic role of CT--comparison with barium enema studies. *Radiology* 1990; 176(1):111-115.
7. Hulnick DH, Megibow AJ, Balthazar EJ, Naidich DP, Bosniak MA. Computed tomography in the evaluation of diverticulitis. *Radiology* 1984; 152(2):491-495.
8. Johnson CD, Baker ME, Rice RP, Silverman P, Thompson WM. Diagnosis of acute colonic diverticulitis: comparison of barium enema and CT. *AJR* 1987; 148(3):541-546.
9. Shrier D, Skucas J, Weiss S. Diverticulitis: an evaluation by computed tomography and contrast enema. *Am J Gastroenterol* 1991; 86(10):1466-1471.
10. Kircher MF, Rhea JT, Kihiczak D, Novelline RA. Frequency, sensitivity, and specificity of individual signs of diverticulitis on thin-section helical CT with colonic contrast material: experience with 312 cases. *AJR* 2002; 178(6):1313-1318.
11. Hachigian MP, Honickman S, Eisenstat TE, Rubin RJ, Salvati EP. Computed tomography in the initial management of acute left-sided diverticulitis. *Dis Colon Rectum* 1992; 35(12):1123-1129.
12. Kaiser AM, Jiang JK, Lake JP, et al. The management of complicated diverticulitis and the role of computed tomography. *Am J Gastroenterol* 2005; 100(4):910-917.
13. Lohrmann C, Ghanem N, Pache G, Makowiec F, Kotter E, Langer M. CT in acute perforated sigmoid diverticulitis. *Eur J Radiol* 2005; 56(1):78-83.
14. Mueller PR, Saini S, Wittenburg J, et al. Sigmoid diverticular abscesses: percutaneous drainage as an adjunct to surgical resection in 24 cases. *Radiology* 1987; 164(2):321-325.
15. Siewert B, Tye G, Kruskal J, et al. Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. *AJR* 2006; 186(3):680-686.
16. Rao PM, Rhea JT, Novelline RA, et al. Helical CT with only colonic contrast material for diagnosing diverticulitis: prospective evaluation of 150 patients. *AJR* 1998; 170(6):1445-1449.
17. Pradel JA, Adell JF, Taourel P, Djafari M, Monnin-Delhom E, Briel JM. Acute colonic diverticulitis: prospective comparative evaluation with US and CT. *Radiology* 1997; 205(2):503-512.
18. Schwerk WB, Schwarz S, Rothmund M. Sonography in acute colonic diverticulitis. A prospective study. *Dis Colon Rectum* 1992; 35(11):1077-1084.
19. Yacoe ME, Jeffrey RB, Jr. Sonography of appendicitis and diverticulitis. *Radiol Clin North Am* 1994; 32(5):899-912.
20. Hollerweger A, Macheiner P, Rettenbacher T, Brunner W, Gritzmann N. Colonic diverticulitis: diagnostic value and appearance of inflamed diverticula-sonographic evaluation. *Eur Radiol* 2001; 11(10):1956-1963.
21. Hollerweger A, Rettenbacher T, Macheiner P, Brunner W, Gritzmann N. Sigmoid diverticulitis: value of transrectal sonography in addition to transabdominal sonography. *AJR* 2000; 175(4):1155-1160.
22. Chintapalli KN, Chopra S, Ghiatas AA, Esola CC, Fields SF, Dodd GD, 3rd. Diverticulitis versus colon cancer: differentiation with helical CT findings. *Radiology* 1999; 210(2):429-435.
23. Padidar AM, Jeffrey RB, Jr., Mindelzun RE, Dolph JF. Differentiating sigmoid diverticulitis from carcinoma on CT scans: mesenteric inflammation suggests diverticulitis. *AJR* 1994; 163(1):81-83.
24. Shen SH, Chen JD, Tiu CM, et al. Differentiating colonic diverticulitis from colon cancer: the value of computed tomography in the emergency setting. *J Chin Med Assoc* 2005; 68(9):411-418.
25. Goh V, Halligan S, Taylor SA, Burling D, Bassett P, Bartram CI. Differentiation between diverticulitis and colorectal cancer: quantitative CT perfusion measurements versus morphologic criteria--initial experience. *Radiology* 2007; 242(2):456-462.
26. American College of Radiology. *Manual on Contrast Media*. Available at: http://www.acr.org/SecondaryMainMenuCategories/quality_safety/contrast_manual.aspx.

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.