

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

**Clinical Condition:**

**Left Lower Quadrant Pain — Suspected Diverticulitis**

**Variant 1:**

**Typical clinical presentation for diverticulitis, suspected complications or atypical presentations.**

<b>Radiologic Procedure</b>	<b>Rating</b>	<b>Comments</b>	<b><u>RRL*</u></b>
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		☼☼☼☼
MRI abdomen and pelvis with or without contrast	5	In patients of childbearing age or if pregnant consider MR. See statement regarding contrast in text under “Anticipated Exceptions.”	O
X-ray contrast enema	4		☼☼☼
US abdomen transabdominal graded compression	4		O
US abdomen transrectal or transvaginal	4		O
X-ray abdomen and pelvis	4		☼☼☼
<b><u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>			<b>*Relative Radiation Level</b>

# LEFT LOWER QUADRANT PAIN — SUSPECTED DIVERTICULITIS

Expert Panel on Gastrointestinal Imaging:  
Frank H. Miller, MD<sup>1</sup>; Max P. Rosen, MD, MPH<sup>2</sup>;  
Tasneem Lalani, MD<sup>3</sup>; Mark E. Baker, MD<sup>4</sup>;  
Michael A. Blake, MB, BCh<sup>5</sup>; Brooks D. Cash, MD<sup>6</sup>;  
Jeff L. Fidler, MD<sup>7</sup>; Frederick L. Greene, MD<sup>8</sup>;  
Nicole M. Hindman, MD<sup>9</sup>; Bronwyn Jones, MD<sup>10</sup>;  
Douglas S. Katz, MD<sup>11</sup>; Harmeet Kaur, MD<sup>12</sup>;  
Aliya Qayyum, MD<sup>13</sup>; William C. Small, MD, PhD<sup>14</sup>;  
Gary S. Sudakoff, MD<sup>15</sup>; Mark Tulchinsky, MD<sup>16</sup>;  
Vahid Yaghmai, MD, MS<sup>17</sup>; Gail M. Yarmish, MD<sup>18</sup>;  
Judy Yee, MD.<sup>19</sup>

## **Summary of Literature Review**

### **Introduction/Background**

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) without suspected complications 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. 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 tests to confirm the diagnosis of diverticulitis, evaluate the extent of disease, and detect complications before deciding on appropriate treatment.

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 magnetic resonance imaging (MRI) has not been adequately evaluated, but preliminary data suggest that it may have diagnostic potential in patients with suspected diverticulitis [1-5]. The imaging test most often used for diagnosing diverticulitis is computed tomography (CT), but graded compression ultrasound (US), barium enema, and MRI have also been used.

### **Barium Enema**

In the past, contrast enema was the primary imaging test for diverticulitis. It currently is performed very uncommonly for this diagnosis. The barium enema has a reported sensitivity of 59%-90% for diagnosing sigmoid diverticulitis [6-10]. The examination, however, is limited, as diverticulitis is mainly an extraluminal process and contrast enema only shows the secondary effects of inflammation on the colon and will not show extraluminal abnormalities including abscesses and pericolic inflammation [11]. Barium enema is also more invasive and is not as sensitive for 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 in some instances as a follow-up study for patients in whom the CT findings cannot unequivocally be used to differentiate diverticulitis from colonic carcinoma, especially if colonoscopy cannot be performed because of narrowing of the colon [6]. When the diagnosis of sigmoid diverticulitis is equivocal (ie, normal CT scan and clinical presentation of left lower quadrant pain) a contrast enema may sometimes be helpful in excluding the sigmoid colon as the source of the pain.

### **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 demonstrate other causes of left lower quadrant pain which mimic diverticulitis. It is widely available, reproducible, and less invasive than the contrast enema, and it has a reported sensitivity of 79%-99% [7-10,12-14]. CT also has major role for determining disease extent; this assessment is rarely possible with contrast enema. By revealing the presence and extent of abscess formation, CT facilitates selection of patients for medical rather than surgical therapy and to determine if hospitalization is required [7-10,12,13,15-17]. When

<sup>1</sup>Principal Author, Northwestern University Feinberg School of Medicine/NMH, Chicago, Illinois.

<sup>2</sup>Panel Chair, Beth Israel Deaconess Medical Center, Boston, Massachusetts.

<sup>3</sup>Panel Vice-chair, Inland Imaging Associates and University of Washington, Seattle, Washington.

<sup>4</sup>Cleveland Clinic, Cleveland, Ohio.

<sup>5</sup>Massachusetts General Hospital, Boston, Massachusetts.

<sup>6</sup>National Naval Medical Center, Bethesda, Maryland, American Gastroenterological Association.

<sup>7</sup>Mayo Clinic, Rochester, Minnesota.

<sup>8</sup>Carolinas Medical Center, Charlotte, North Carolina, American College of Surgeons.

<sup>9</sup>New York University Medical Center, New York, New York.

<sup>10</sup>Johns Hopkins Hospital, Baltimore, Maryland.

<sup>11</sup>Winthrop University Hospital, Mineola, New York.

<sup>12</sup>MD Anderson Cancer Center, Houston, Texas.

<sup>13</sup>University of California San Francisco, San Francisco, California.

<sup>14</sup>Emory University, Atlanta, Georgia.

<sup>15</sup>Medical College of Wisconsin, Milwaukee, Wisconsin.

<sup>16</sup>Milton S. Hershey Medical Center, Hershey, Pennsylvania, Society of Nuclear Medicine.

<sup>17</sup>Northwestern University, Chicago, Illinois.

<sup>18</sup>Staten Island University Hospitals, Staten Island, New York.

<sup>19</sup>University of California San Francisco, San Francisco, California.

The American College of Radiology seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply individual or society endorsement of the final document.

Reprint requests to: Department of Quality & Safety, American College of Radiology, 1891 Preston White Drive, Reston, VA 20191-4397.

abscesses are present, it has been shown that US- and CT-guided percutaneous drainage of abscess collections can eliminate multistage operative procedures and, in some cases, can eliminate the need for surgery entirely [15,16,18,19]. Finally, CT can demonstrate extracolonic diseases (eg, genitourinary and gynecologic abnormalities) which have a similar clinical presentation. It reveals the alternative diagnosis of epiploic appendicitis which can clinically present similarly [20,21]. 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](#).”

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, although regardless of the technique used the accuracy is high [22].

### 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 [23-25]. Graded compression sonography is reported to have a sensitivity of 77%-98% and a specificity of 80%-99% in diagnosing diverticulitis [23,24,26]. One meta-analysis study suggested that graded compression US and CT are both effective initial diagnostic tools but that CT is more likely to reveal alternative diagnoses for left lower quadrant pain [26]. Some investigators advocate the selective use of transrectal sonography to improve detection of diverticulitis if the findings on transabdominal sonography are negative or equivocal [27]. In one study, the sensitivity of US was lower than that of CT when correlated with histopathology that is thought to be related to complicated diverticulitis, whereas CT was better in showing extraluminal air and abscesses [28]. Transvaginal sonography is of particular 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 depicting gynecologic abnormalities that cause left lower quadrant pain. However, graded compression sonography for diverticulitis is a technique that is highly operator dependent, requiring a high level of expertise. US for diverticulitis is not widely used especially in the United States. Sonography is also much more dependent on body habitus than CT or MR — especially for imaging of a relatively posterior structure such as the descending and sigmoid colon.

### Magnetic Resonance Imaging

The role of MRI in the setting of left lower quadrant pain has not been adequately evaluated, but preliminary data suggest that it may have diagnostic potential in patients with suspected diverticulitis [1-5]. The findings for MRI

are similar to those for CT, including demonstration of complications of diverticulitis; however, MRI, like US, has lower sensitivity for detecting small amounts of extraluminal air than CT. There is a potential role for MRI in imaging younger patients with recurrent episodes of known or suspected diverticulitis in order to reduce radiation exposure, although it has not been systematically evaluated.

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 rather than diverticulitis include the presence of pericolonic lymphadenopathy (1 cm), with or without pericolonic edema. When there are inflammatory changes, edema in the root of the sigmoid mesentery, and no pericolonic lymphadenopathy adjacent to a segment of thickened colon wall, the most likely diagnosis is diverticulitis [29-31]. 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 [32].

### 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 show the presence of extracolonic disease in these patients.
- Abdominal radiography and barium enema play a far less significant role and should not be used as the primary modality for the diagnosis.
- US, although effective when performed by experienced users, is used less widely in the United States and has limitations in the setting of complicated diverticulitis.
- MRI, while potentially effective in the diagnosis of diverticulitis, is not widely used for this purpose at present. No large prospective studies to our knowledge have compared MRI with CT in the diagnosis of diverticulitis.

### 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/1.73m<sup>2</sup>), 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/1.73m<sup>2</sup>. For more information, please see the [ACR Manual on Contrast Media](#) [33].

### 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<sup>®</sup> [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<sup>®</sup> Overview](#)
- [Procedure 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, Sitter H, Zielke A, Klose KJ. Prospective evaluation of the value of magnetic resonance imaging in suspected acute sigmoid diverticulitis. *Dis Colon Rectum* 2008; 51(12):1810-1815.
4. 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.
5. 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.
6. 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.
7. 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.
8. Hulnick DH, Megibow AJ, Balthazar EJ, Naidich DP, Bosniak MA. Computed tomography in the evaluation of diverticulitis. *Radiology* 1984; 152(2):491-495.
9. 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.
10. Shrier D, Skucas J, Weiss S. Diverticulitis: an evaluation by computed tomography and contrast enema. *Am J Gastroenterol* 1991; 86(10):1466-1471.
11. 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.
12. 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.
13. Ambrosetti P, Becker C, Terrier F. Colonic diverticulitis: impact of imaging on surgical management -- a prospective study of 542 patients. *Eur Radiol* 2002; 12(5):1145-1149.
14. Kaewlai R, Nazinitsky KJ. Acute colonic diverticulitis in a community-based hospital: CT evaluation in 138 patients. *Emerg Radiol* 2007; 13(4):171-179.
15. 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.
16. 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.
17. Al-Sahaf O, Al-Azawi D, Fauzi MZ, El-Masry S, Gillen P. Early discharge policy of patients with acute colonic diverticulitis following initial CT scan. *Int J Colorectal Dis* 2008; 23(8):817-820.
18. 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.
19. 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.
20. Jalaguier A, Zins M, Rodallec M, Nakache JP, Boulay-Coletta I, Julles MC. Accuracy of multidetector computed tomography in differentiating primary epiploic appendagitis from left acute colonic diverticulitis associated with secondary epiploic appendagitis. *Emerg Radiol* 2010; 17(1):51-56.

21. Singh AK, Gervais DA, Hahn PF, Rhea J, Mueller PR. CT appearance of acute appendicitis. *AJR* 2004; 183(5):1303-1307.
22. 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.
23. Pradel JA, Adell JF, Taourel P, Djafari M, Monnin-Delhom E, Bruel JM. Acute colonic diverticulitis: prospective comparative evaluation with US and CT. *Radiology* 1997; 205(2):503-512.
24. Schwerk WB, Schwarz S, Rothmund M. Sonography in acute colonic diverticulitis. A prospective study. *Dis Colon Rectum* 1992; 35(11):1077-1084.
25. Yacoe ME, Jeffrey RB, Jr. Sonography of appendicitis and diverticulitis. *Radiol Clin North Am* 1994; 32(5):899-912.
26. Ripolles T, Agramunt M, Martinez MJ, Costa S, Gomez-Abril SA, Richart J. The role of ultrasound in the diagnosis, management and evolutive prognosis of acute left-sided colonic diverticulitis: a review of 208 patients. *Eur Radiol* 2003; 13(12):2587-2595.
27. 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.
28. Lameris W, van Randen A, Bipat S, Bossuyt PM, Boermeester MA, Stoker J. Graded compression ultrasonography and computed tomography in acute colonic diverticulitis: meta-analysis of test accuracy. *Eur Radiol* 2008; 18(11):2498-2511.
29. 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.
30. 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.
31. 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.
32. 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.
33. American College of Radiology. *Manual on Contrast Media*. Available at: [http://www.acr.org/SecondaryMainMenuCategories/quality\\_safety/contrast\\_manual.aspx](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.