

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. <i>Am J Epidemiol</i> 1990; 132(5):910-925.	Review/Other-Dx	N/A	To describe epidemiology of appendicitis in the United States.	Rates of appendectomy in different subgroups. Highest rate was found in women (35-44 years). Overall, an estimated 36 incidental procedures are performed to prevent one case of appendicitis.	4
2. Wagner JM, McKinney WP, Carpenter JL. Does this patient have appendicitis? <i>JAMA</i> 1996; 276(19):1589-1594.	Review/Other-Dx	N/A	To review clinical signs and diagnostic tests for appendicitis.	No results stated.	4
3. Bachur RG, Hennelly K, Callahan MJ, Chen C, Monuteaux MC. Diagnostic imaging and negative appendectomy rates in children: effects of age and gender. <i>Pediatrics</i> 2012; 129(5):877-884.	Observational-Dx	8,959,155 visits at 40 pediatric emergency departments; 55,227 children	To examine the use of CT and US for age and gender subgroups of children undergoing an appendectomy and to study the association between imaging and negative appendectomy rates (NARs) among these subgroups.	The negative appendectomy rate was 3.6%. Negative appendectomy rates were highest for children <5 years (boys 16.8%, girls 14.6%) and girls >10 years (4.8%). At the institutional level, increased rates of diagnostic imaging (US and/or CT) were associated with lower negative appendectomy rates for all age and gender subgroups other than children <5 years. The negative appendectomy rates was 1.2% for boys >5 years without any diagnostic imaging.	3
4. Sun JS, Noh HW, Min YG, et al. Receiver operating characteristic analysis of the diagnostic performance of a computed tomographic examination and the Alvarado score for diagnosing acute appendicitis: emphasis on age and sex of the patients. <i>J Comput Assist Tomogr</i> 2008; 32(3):386-391.	Observational-Dx	372 patients	To compare, retrospectively, the diagnostic performance of CT and the Alvarado score and to determine whether patient age and sex influence the use of CT and the Alvarado score for diagnosing acute appendicitis.	There was little effect of patient age and sex on diagnostic performance of CT. However, the diagnostic performance of the Alvarado score was variable according to the patient age and sex (lowest in older women). Overall sensitivity of the Alvarado score was too low (72.8%) for determining immediate surgical intervention. The Alvarado score should be supplemented with CT examination for accurate diagnosis of acute appendicitis.	3
5. Applegate KE, Sivit CJ, Salvator AE, et al. Effect of cross-sectional imaging on negative appendectomy and perforation rates in children. <i>Radiology</i> 2001; 220(1):103-107.	Observational-Dx	292 children	To compare negative appendectomy and perforation rates in children who underwent US, CT, or no imaging before urgent appendectomy.	Higher rates of appendectomy with normal pathologic findings (“negative appendectomy”) in patients who underwent no imaging (14% [18/126]) or US (17% [20/121]) vs the rates in those who underwent CT only (2% [1/52]) (P=.02 and P=.007, respectively).	3

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6. Bendeck SE, Nino-Murcia M, Berry GJ, Jeffrey RB, Jr. Imaging for suspected appendicitis: negative appendectomy and perforation rates. <i>Radiology</i> 2002; 225(1):131-136.	Observational-Dx	462 patients	Retrospective review of records to determine which patients suspected of having acute appendicitis benefit from preoperative imaging. CT or US performed in 313 patients.	Sensitivity of CT and US for diagnosing acute appendicitis exceeded 93% and 77%, respectively, in all groups. The PPV for both CT and US were greater than 92% in all groups. Women suspected of having appendicitis benefit the most from preoperative CT or US, with a statistically significantly lower negative appendectomy rate than women who undergo no preoperative imaging.	3
7. Chooi WK, Brown JA, Zetler P, Wiseman S, Cooperberg P. Imaging of acute appendicitis and its impact on negative appendectomy and perforation rates: the St. Paul's experience. <i>Can Assoc Radiol J</i> 2007; 58(4):220-224.	Review/Other-Dx	380 appendectomies	To determine the prevalence of preoperative imaging of acute appendicitis in our institution and its effect on the negative appendectomy rate and perforation rates.	A total of 380 appendectomies were performed over this time period for the preoperative diagnosis of acute appendicitis. 59 patients had histologically normal appendices, giving an overall negative appendectomy rate of 15.5%. Overall, patients who had preoperative imaging showed a lower negative appendectomy rate (11.4%) than did those without imaging (22.2%). Without preoperative imaging, women had a higher negative appendectomy rate (34.3%) than did men (17.4%). Reduction in the negative appendectomy rate was demonstrated with preoperative imaging in both sexes (16.7% and 5.7%, respectively). Also demonstrated is a definite trend toward increased use of preoperative CT and away from US as the sole preoperative imaging modality. This is associated with a reduced negative appendectomy rate.	4

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8. Cuschieri J, Florence M, Flum DR, et al. Negative appendectomy and imaging accuracy in the Washington State Surgical Care and Outcomes Assessment Program. <i>Ann Surg</i> 2008; 248(4):557-563.	Observational-Dx	3,540 patients	To evaluate negative appendectomy and the relationship of negative appendectomy and CT and/or US.	The percentage of patients who had imaging (CT-91%) was 86% (women-89%, men-83%). The use of imaging ranged across hospitals from 56% to 97%. There was 91% agreement between imaging and pathology report findings (92.3%-CT and 82.4%-US). The overall rate of negative appendectomy was 6% (women-8%, men-4%). The prevalence of negative appendectomy was 9.8% among patients having no imaging, 8.1% among those having an US, and 4.5% in those having a CT. Among patients with negative appendectomy, CT/US was obtained in 75%; correct in 10% and incorrect or ambiguous in 65%. Higher rates of negative appendectomy were correlated with lower rates of CT/US concordance ( $r = -0.57$ ). There was no significant difference in rates of perforation between those with (17%) and without (15%) imaging ( $P=0.2$ ). There were significant increases in the use of CT/US and decreases in negative appendectomy over the time period ( $P<0.01$ ).	3

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9. Kim K, Lee CC, Song KJ, Kim W, Suh G, Singer AJ. The impact of helical computed tomography on the negative appendectomy rate: a multi-center comparison. <i>J Emerg Med</i> 2008; 34(1):3-6.	Observational-Dx	339 patients	To explore the association between CT utilization rates and the negative appendectomy rates in patients with suspected appendicitis at 3 medical centers.	Of the 339 patients included, 242 (71.4%) were imaged with abdominal CT before appendectomy (CT group), whereas the remaining patients were not (non-CT group). 36/339 patients (10.6%) were found to have negative appendectomies. The CT group had a significantly lower negative appendectomy rate than the non-CT group (6.6% vs 20.6%, respectively, P<0.05). The 3 centers had significantly different rates of CT utilization for diagnosing acute appendicitis (86.9%, 66.4%, and 13.3%, P<0.05). These 3 centers also had significantly different negative appendectomy rates (2.5%, 16.8%, and 23.3%, P<0.05). There was a significant inverse correlation (rho = -1, P<0.05) between CT utilization rates and negative appendectomy rates. The rate of negative appendectomies in this retrospective study was inversely related to the rates of CT imaging before exploration in Emergency Department patients with suspected appendicitis.	3
10. Lee CC, Golub R, Singer AJ, Cantu R, Jr., Levinson H. Routine versus selective abdominal computed tomography scan in the evaluation of right lower quadrant pain: a randomized controlled trial. <i>Acad Emerg Med</i> 2007; 14(2):117-122.	Experimental-Dx	152 patients	To determine if selective vs routine use of CT has an effect on negative appendectomy rate and appendiceal perforation.	Mandatory CT reduced by 11.3% the negative appendectomy rate and by 8.2% the rate of perforated appendicitis.	2
11. Partrick DA, Janik JE, Janik JS, Bensard DD, Karrer FM. Increased CT scan utilization does not improve the diagnostic accuracy of appendicitis in children. <i>J Pediatr Surg</i> 2003; 38(5):659-662.	Observational-Dx	616 children	CT and US in acute appendicitis. Effect on surgical outcome.	No effect on unnecessary laparotomies after imaging.	3

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12. Raja AS, Wright C, Sodickson AD, et al. Negative appendectomy rate in the era of CT: an 18-year perspective. <i>Radiology</i> 2010; 256(2):460-465.	Observational-Dx	719-bed tertiary care adult teaching hospital; 58,000 annual emergency department visits	To estimate the correlation between the negative appendectomy rate and the rate of preoperative CT in patients suspected of having acute appendicitis who presented to the emergency department during an 18-year period.	From 1990 to 2007, the negative appendectomy rate decreased significantly from 23.0% to 1.7% (P<.0001), the annual number of appendectomies decreased significantly from 217 per year to 119 per year (P=.0003), and the proportion of patients undergoing appendectomy who underwent preoperative CT increased significantly from 1% to 97.5% (P<.0001).	4
13. Rao PM, Rhea JT, Novelline RA, Mostafavi AA, McCabe CJ. Effect of computed tomography of the appendix on treatment of patients and use of hospital resources. <i>N Engl J Med</i> 1998; 338(3):141-146.	Observational-Dx	100 patients	To determine effect of routine CT of the appendix on the treatment of patients with acute appendicitis and use of hospital resources.	CT improves patient care and reduces the use of hospital resources.	3
14. Rao PM, Rhea JT, Rattner DW, Venus LG, Novelline RA. Introduction of appendiceal CT: impact on negative appendectomy and appendiceal perforation rates. <i>Ann Surg</i> 1999; 229(3):344-349.	Observational-Dx	493 (1992-1995) 209 (1997) 206 (without subsequent appendectomy)	Review medical records to evaluate the impact of appendiceal CT availability on negative appendectomy and appendiceal perforation rates.	Availability of appendiceal CT coincided with a drop in the negative appendectomy rate from 20% to 7% in all patients, and to only 3% in patients with a positive CT. Perforation rates decreased from 22% to 14%.	3
15. Hershko DD, Sroka G, Bahouth H, Ghersin E, Mahajna A, Krausz MM. The role of selective computed tomography in the diagnosis and management of suspected acute appendicitis. <i>Am Surg</i> 2002; 68(11):1003-1007.	Observational-Dx	308 patients	To determine impact of selective use of CT for acute appendicitis.	CT performed in 198 patients. Sensitivity, specificity and accuracy of CT was 91%, 92%, and 91%, respectively. Negative appendectomy rate with selective use of CT is 16%. Recommended selective use in men and routine use in women.	2
16. Raman SS, Lu DS, Kadell BM, Vodopich DJ, Sayre J, Cryer H. Accuracy of nonfocused helical CT for the diagnosis of acute appendicitis: a 5-year review. <i>AJR</i> 2002; 178(6):1319-1325.	Observational-Dx	650 patients	Multi-year review of accuracy of CT for diagnosis of acute appendicitis.	Very high accuracy for CT for presence or absence of appendicitis and identification of alternate diagnosis in 66% of cases.	3
17. van Randen A, Bipat S, Zwinderman AH, Ubbink DT, Stoker J, Boermeester MA. Acute appendicitis: meta-analysis of diagnostic performance of CT and graded compression US related to prevalence of disease. <i>Radiology</i> 2008; 249(1):97-106.	Review/Other-Dx	6 studies; 671 patients	Meta-analysis of diagnostic performance of CT and graded compression US to diagnose acute appendicitis.	CT had a better test performance than did graded compression US in diagnosing appendicitis. Ignoring the relationship between prevalence (pretest probability) and diagnostic value may lead to an inaccurate estimation of diagnostic performance.	4

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18. Chen SC, Chen KM, Wang SM, Chang KJ. Abdominal sonography screening of clinically diagnosed or suspected appendicitis before surgery. <i>World J Surg</i> 1998; 22(5):449-452.	Observational-Dx	191 patients	Prospective study to determine accuracy of abdominal US in the diagnosis of acute appendicitis.	Abdominal US for detecting acute appendicitis had a sensitivity of 99.3%, a specificity of 68.1%, accuracy of 91.6%, PPV of 90.5%, and NPV of 97.0%. US reasonably accurate in appendicitis.	3
19. Morse BC, Roettger RH, Kalbaugh CA, Blackhurst DW, Hines WB, Jr. Abdominal CT scanning in reproductive-age women with right lower quadrant abdominal pain: does its use reduce negative appendectomy rates and healthcare costs? <i>Am Surg</i> 2007; 73(6):580-584; discussion 584.	Observational-Dx	439 patients	To determine if abdominal CT scanning is an effective test in making the diagnosis of acute appendicitis in reproductive-age women (age, 16-49 years) with right lower quadrant abdominal pain and to determine if its use is cost-effective.	In the subgroup of reproductive-age women, there was a significant difference in negative appendectomy rates of 17% in the group that received abdominal CT scans vs 42% in the group that did not (P< 0.038). After accounting for the patient and insurance company costs, abdominal CT scan savings averaged \$1,412 per patient.	4
20. Krajewski S, Brown J, Phang PT, Raval M, Brown CJ. Impact of computed tomography of the abdomen on clinical outcomes in patients with acute right lower quadrant pain: a meta-analysis. <i>Can J Surg</i> 2011; 54(1):43-53.	Review/Other-Dx	28 articles	To evaluate the impact of abdominal CT on the clinical outcomes of patients presenting with suspected appendicitis.	The negative appendectomy rate was 8.7% when using CT compared with 16.7% when using clinical evaluation alone (P<0.001). There was also a significantly lower negative appendectomy rate during the CT era compared with the pre-CT era (10.0% vs 21.5%, P<0.001). Time to surgery was evaluated in 10 of the 28 studies, 5 of which demonstrated a significant increase in the time to surgery with the use of CT. Appendiceal perforation rates were unchanged by the use of CT (23.4% in the CT group vs 16.7% in the clinical evaluation group, P=0.15). Similarly, the perforation rate during the CT era was not significantly different than that during the pre-CT era (20.0% vs 19.6%, P=0.74).	4
21. Coursey CA, Nelson RC, Patel MB, et al. Making the diagnosis of acute appendicitis: do more preoperative CT scans mean fewer negative appendectomies? A 10-year study. <i>Radiology</i> 2010; 254(2):460-468.	Observational-Dx	925 patients; 526 men, 399 women	To determine the frequency of preoperative CT in the evaluation of patients suspected of having appendicitis at one institution during the past 10 years and to determine whether changes in CT utilization were associated with changes in the negative appendectomy rate.	Prior to urgent appendectomy, 18.5% of patients underwent preoperative CT in 1998 compared with 93.2% of patients in 2007. The negative appendectomy rate for women ≤45 years of age decreased from 42.9% in 1998 to 7.1% in 2007. However, the timing of the decline in negative appendectomy rates for women ≤45 years of age could not be proved to be associated with the increase in CT use. There was no significant trend toward a lower negative appendectomy rate for men regardless of age or for women older than 45 years of age with increased use of preoperative CT.	3

\* See Last Page for Key

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22. Rybkin AV, Thoeni RF. Current concepts in imaging of appendicitis. <i>Radiol Clin North Am</i> 2007; 45(3):411-422, vii.	Review/Other-Dx	N/A	Reviews the current imaging methods and diagnostic features of appendicitis.	CT and US are widely recognized as very useful in the timely diagnosis of appendicitis. MRI is emerging as an alternative to CT in pregnant patients and in patients who have an allergy to iodinated contrast material.	4
23. Pooler BD, Lawrence EM, Pickhardt PJ. MDCT for suspected appendicitis in the elderly: diagnostic performance and patient outcome. <i>Emerg Radiol</i> 2012; 19(1):27-33.	Observational-Dx	262 consecutive adult patients	To assess the diagnostic performance of CT in a consecutive elderly cohort with clinically suspected appendicitis.	The overall prevalence of proven acute appendicitis in this elderly cohort with clinically suspected appendicitis was 16.8% (44/262). CT sensitivity, specificity, PPV, and NPV for acute appendicitis were 100% (44/44), 99.1% (216/218), 95.7% (44/46), and 100.0% (216/216), respectively. The negative appendectomy rate was 2.3% (1/43). The perforation rate was 40.9% (18/44). There were no false-negative and two false-positive CT interpretations. All patients with appendicitis suspected on CT were hospitalized (44/44), with an average stay of 5.7 +/- 3.2 days, and 93.5% (43/46) underwent appendectomy. Overall surgical complication rate was 34.9% (15/43). Compared with younger adults over the same period, elderly patients had higher rates of perforation and surgical complications, and longer hospital stays (P<0.003).	3
24. Toorenvliet BR, Wiersma F, Bakker RF, Merkus JW, Breslau PJ, Hamming JF. Routine ultrasound and limited computed tomography for the diagnosis of acute appendicitis. <i>World J Surg</i> 2010; 34(10):2278-2285.	Observational-Dx	802 patients	To investigate a diagnostic pathway that uses routine US, limited CT, and clinical re-evaluation for patients with acute appendicitis.	Additional radiological imaging was performed in 96.3% of patients with suspected appendicitis (n=164). Use of CT was kept to a minimum (17.9%), with a US:CT ratio of approximately 6:1. PPV and NPV for the clinical diagnosis of appendicitis were 63% and 98%, respectively; for US 94% and 97%, respectively; and for CT 100% and 100%, respectively. The negative appendicitis rate was 3.3%, the perforation rate was 23.5%, and the missed perforated appendicitis rate was 3.4%. No (diagnostic) laparoscopies were performed.	3

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25. Poortman P, Oostvogel HJ, Bosma E, et al. Improving diagnosis of acute appendicitis: results of a diagnostic pathway with standard use of ultrasonography followed by selective use of CT. <i>J Am Coll Surg</i> 2009; 208(3):434-441.	Observational-Dx	151 patients	To assess the accuracy of a diagnostic pathway in acute appendicitis using US and complementary contrast-enhanced MDCT in a general community teaching hospital.	Positive US was confirmed at operation in 71/79 patients and positive CT was confirmed in all 21 patients. All 39 patients with negative CT findings recovered without operations. The negative appendicitis rate was 8% and perforation rate was 9%. The sensitivity and specificity of US was 77% and 86%, respectively. The sensitivity and specificity of CT was both 100%. The sensitivity and specificity of the whole diagnostic pathway was 100% and 86%, respectively.	3
26. Poletti PA, Platon A, De Perrot T, et al. Acute appendicitis: prospective evaluation of a diagnostic algorithm integrating ultrasound and low-dose CT to reduce the need of standard CT. <i>Eur Radiol</i> 2011; 21(12):2558-2566.	Observational-Dx	183 consecutive patients	To evaluate an algorithm integrating US and low-dose unenhanced CT with oral contrast medium in the assessment of acute appendicitis, to reduce the need of conventional CT.	No further imaging was recommended after US in 84 (46%) patients; low-dose CT was obtained in 99 (54%). low-dose CT was positive or negative for appendicitis in 81 (82%) of these 99 patients, indeterminate in 18 (18%) who underwent standard CT. 86 (47%) of the 183 patients had a surgically proven appendicitis. The sensitivity and specificity of the algorithm were 98.8% and 96.9%.	3
27. Kim K, Kim YH, Kim SY, et al. Low-dose abdominal CT for evaluating suspected appendicitis. <i>N Engl J Med</i> 2012; 366(17):1596-1605.	Experimental-Dx	891 patients	To evaluate the rate of negative (unnecessary) appendectomy after low-dose vs standard-dose abdominal CT in young adults with suspected appendicitis.	The negative appendectomy rate was 3.5% (6/172 patients) in the low-dose CT group and 3.2% (6/186 patients) in the standard-dose CT group (difference, 0.3 percentage points; 95% CI, -3.8 to 4.6). The 2 groups did not differ significantly in terms of the appendiceal perforation rate (26.5% with low-dose CT and 23.3% with standard-dose CT, P=0.46) or the proportion of patients who needed additional imaging tests (3.2% and 1.6%, respectively; P=0.09).	3
28. Johnson PT, Horton KM, Kawamoto S, et al. MDCT for suspected appendicitis: effect of reconstruction section thickness on diagnostic accuracy, rate of appendiceal visualization, and reader confidence using axial images. <i>AJR</i> 2009; 192(4):893-901.	Observational-Dx	212 patients	To evaluate interpretative performance with different MDCT reconstruction parameters in adult patients with suspected appendicitis.	Progressively thinner reconstruction section thickness was associated with a significant increase in the rate of visualization of the appendix, visualization confidence, and confidence for presence or absence of findings. Correctness of diagnosis was not significantly associated with reconstruction method. However, for correctly diagnosed cases interpreted as normal, impression confidence increased with progressively thinner section thickness.	1

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29. Kim HC, Yang DM, Jin W, Park SJ. Added diagnostic value of multiplanar reformation of multidetector CT data in patients with suspected appendicitis. <i>Radiographics</i> 2008; 28(2):393-405; discussion 405-396.	Review/Other-Dx	N/A	Summary of how multiplanar reformation of MDCT data may provide improved appendiceal visualization and increase the physician's confidence in diagnosing appendicitis.	Radiologist should obtain multiplanar reformation images in the evaluation of patients with suspected appendicitis to help ensure the correct diagnosis.	4
30. Neville AM, Paulson EK. MDCT of acute appendicitis: value of coronal reformations. <i>Abdom Imaging</i> 2009; 34(1):42-48.	Review/Other-Dx	N/A	To review the utility of CT in suspected acute appendicitis and the potential added diagnostic value of coronal reformations in confirming or excluding the diagnosis.	Coronal reformations can be a useful adjunct to axial images in the workup of acute appendicitis and can improve physician confidence in both the diagnosis and exclusion of the diagnosis. It may improve diagnostic accuracy of CT.	4
31. Dearing DD, Recabaren JA, Alexander M. Can computed tomography scan be performed effectively in the diagnosis of acute appendicitis without the added morbidity of rectal contrast? <i>Am Surg</i> 2008; 74(10):917-920.	Observational-Dx	238 patients	To determine whether CT can be performed effectively in the diagnosis of acute appendicitis without the added morbidity of rectal contrast.	CT scanning without rectal contrast is effective for the diagnosis of acute appendicitis making rectal contrast unnecessary.	3
32. Hershko DD, Awad N, Fischer D, et al. Focused helical CT using rectal contrast material only as the preferred technique for the diagnosis of suspected acute appendicitis: a prospective, randomized, controlled study comparing three different techniques. <i>Dis Colon Rectum</i> 2007; 50(8):1223-1229.	Experimental-Dx	232 patients	To prospectively compare the efficacy of rectal contrast CT to other commonly used contrast-enhanced and nonenhanced CT techniques for the detection of acute appendicitis.	The sensitivity, specificity, and overall accuracy rates of rectal contrast CT were 93%, 95%, and 94 %, respectively. The sensitivity, specificity, and overall accuracy rates of dual-contrast CT were 100%, 89%, and 94%, respectively. The sensitivity, specificity, and overall accuracy of noncontrast enhanced CT were 90%, 86%, and 70%, respectively. Rectal contrast CT is as accurate, although less sensitive, compared with dual-contrast CT and significantly superior to noncontrast-enhanced CT.	2
33. Lane MJ, Liu DM, Huynh MD, Jeffrey RB, Jr., Mindelzun RE, Katz DS. Suspected acute appendicitis: nonenhanced helical CT in 300 consecutive patients. <i>Radiology</i> 1999; 213(2):341-346.	Observational-Dx	300 consecutive patients	To determine the accuracy of helical CT without the oral, IV, or rectal administration of contrast material in confirming suspected acute appendicitis.	Sensitivity 96%; specificity 99%, and accuracy 97%.	3

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34. Hlibczuk V, Dattaro JA, Jin Z, Falzon L, Brown MD. Diagnostic accuracy of noncontrast computed tomography for appendicitis in adults: a systematic review. <i>Ann Emerg Med</i> 2010; 55(1):51-59 e51.	Review/Other-Dx	7 studies; 1,060 patients	To determine the diagnostic test characteristics of noncontrast CT for appendicitis in the adult emergency department population.	The included studies were of high methodological quality with respect to appropriate patient spectrum and reference standard. The pooled estimates for sensitivity and specificity were 92.7% (95% CI, 89.5% to 95.0%) and 96.1% (95% CI, 94.2% to 97.5%), respectively; the positive likelihood ratio=24 and the negative likelihood ratio=0.08.	4
35. Berg ER, Mehta SD, Mitchell P, Soto J, Oyama L, Ulrich A. Length of stay by route of contrast administration for diagnosis of appendicitis by computed-tomography scan. <i>Acad Emerg Med</i> 2006; 13(10):1040-1045.	Observational-Dx	112: 56 rectal contrast; 56 oral contrast	To evaluate whether emergency department length of stay and satisfaction differed by route of contrast administration for abdominal CT.	There was a significant decrease in length of stay for patients who were administered rectal contrast (261 minutes, 95% CI, 236 to 305 minutes) vs oral contrast (332 minutes, 95% CI, 299 to 362 minutes), P=0.009. Although subjects in the rectal-contrast group waited 65 minutes longer than did oral-contrast patients before receiving contrast after the CT order, the time from contrast administration to CT was 13 minutes vs 150 minutes for patients receiving oral contrast (P<0.001). Rectal contrast for patients undergoing abdominal CT to rule out appendicitis reduced emergency department length of stay by more than an hour and did not affect patient satisfaction or discomfort.	4
36. Anderson SW, Soto JA, Lucey BC, et al. Abdominal 64-MDCT for suspected appendicitis: the use of oral and IV contrast material versus IV contrast material only. <i>AJR</i> 2009; 193(5):1282-1288.	Experimental-Dx	303: 151-Group 1: 64 MDCT with oral and IV contrast; 152-Group 2: 64-MDCT with IV contrast only	To compare the diagnostic accuracy of IV contrast-enhanced 64-MDCT with and without the use of oral contrast material in diagnosing appendicitis in patients with abdominal pain.	Group 1: Sensitivity 100%, specificity 97.1%. Group 2: Sensitivity 100%, specificity 97.1%. Similar characteristics were seen using with or without oral contrast.	2

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37. Kepner AM, Bacasnot JV, Stahlman BA. Intravenous contrast alone vs intravenous and oral contrast computed tomography for the diagnosis of appendicitis in adult ED patients. <i>Am J Emerg Med</i> 2012; 30(9):1765-1773.	Experimental-Dx	114 IV patients and 113 IV and oral contrast patients	To compare CT with IV contrast alone to CT with IV and oral contrast in adult patients with suspected appendicitis.	Both IV (n=114) and IV and oral contrast (n=113) scans had 100% sensitivity (95% CI, 89.3-100 and 87.4-100, respectively) and NPV (95% CI, 93.7-100 and 93.9-100, respectively) for appendicitis. Specificity of IV and IV and oral contrast scans was 98.6% and 94.9% (95% CI, 91.6-99.9 and 86.9-98.4, respectively), respectively, with PPVs of 97.6% and 89.5% (95% CI, 85.9-99.9 and 74.2-96.6). Median times to emergency department disposition and operating room were 1 hour and 31 minutes (P<.0001) and 1 hour and 10 minutes (P=.089) faster for the IV group, respectively. Patients with negative IV scans were discharged nearly 2 hours faster (P=.001).	2
38. Keyzer C, Cullus P, Tack D, De Maertelaer V, Bohy P, Gevenois PA. MDCT for suspected acute appendicitis in adults: impact of oral and IV contrast media at standard-dose and simulated low-dose techniques. <i>AJR</i> 2009; 193(5):1272-1281.	Experimental-Dx	131 consecutive patients	To prospectively investigate the influence of oral, IV, and oral and IV contrast media on the information provided by MDCT at standard and simulated low radiation doses in adults suspected of having acute appendicitis.	Factorial analysis and ascending hierarchic classification revealed that, in terms of diagnostic correctness, reader influence predominated over the influence of IV and oral contrast media use and radiation dose but that correctness was also influenced by the patient's sex (P=0.048) and was lower in cases of alternative diseases (P<0.001). Visualization of the appendix depended predominantly on the reader rather than on the use of IV, oral, or oral and IV contrast agents or on radiation dose.	2
39. Jeffrey RB, Jr., Tolentino CS, Federle MP, Laing FC. Percutaneous drainage of periappendiceal abscesses: review of 20 patients. <i>AJR</i> 1987; 149(1):59-62.	Review/Other-Dx	20 patients	To review treatment of patients with periappendiceal abscess.	Percutaneous therapy effective.	4
40. Nunez D, Jr., Yrizarry JM, Casillas VJ, Becerra J, Russell E. Percutaneous management of appendiceal abscesses. <i>Semin Ultrasound CT MR</i> 1989; 10(4):348-351.	Review/Other-Dx	N/A	Percutaneous management of appendiceal abscess.	Conservative medical management with percutaneous drainage if needed. Surgery less desirable.	4

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41. Lasson A, Lundagards J, Loren I, Nilsson PE. Appendiceal abscesses: primary percutaneous drainage and selective interval appendectomy. <i>Eur J Surg</i> 2002; 168(5):264-269.	Review/Other-Dx	24 patients	To present results of non-surgical primary management of appendiceal abscesses using ultrasonic percutaneous drainage under local anesthesia, and selective interval appendectomy.	All patients had their abscesses drained successfully without complications. One patient continued to have fever, but eventually responded to conservative treatment and in one the bowel was perforated by the drain but again this was treated conservatively. Four abscesses recurred. Seven patients underwent planned interval appendectomy. Another three patients were also operated on; one for caecal adenocarcinoma, and two for persisting symptoms and enterocutaneous fistulas.	4
42. Marin D, Ho LM, Barnhart H, Neville AM, White RR, Paulson EK. Percutaneous abscess drainage in patients with perforated acute appendicitis: effectiveness, safety, and prediction of outcome. <i>AJR</i> 2010; 194(2):422-429.	Observational-Dx	41 patients	To retrospectively investigate the effectiveness and safety of CT-guided percutaneous drainage in the treatment of patients with acute appendicitis complicated by perforation and to identify CT findings and procedure-related factors predictive of clinical and procedure outcome.	52 CT-guided procedures were performed on 41 patients. Percutaneous drainage had clinical and technical success rates of 90% (37/41 patients, 47/52 procedures) with no procedure-related complications. In 7 patients (19%) clinical success required repeated drainage procedures. A large, poorly defined periappendiceal abscess and an extraluminal appendicolith on preprocedural CT images were independent predictors of clinical failure of percutaneous drainage.	4

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
43. Pickhardt PJ, Lawrence EM, Pooler BD, Bruce RJ. Diagnostic performance of multidetector computed tomography for suspected acute appendicitis. <i>Ann Intern Med</i> 2011; 154(12):789-796, W-291.	Observational-Dx	2,871 adults	To evaluate the diagnostic performance of MDCT for suspected acute appendicitis in adults.	675/2,871 patients (23.5%) had confirmed acute appendicitis. The sensitivity, specificity, and NPV and PPV of MDCT were 98.5% (95% CI, 97.3% to 99.2%) (665/675 patients), 98.0% (CI, 97.4% to 98.6%) (2,153/2,196 patients), 99.5% (CI, 99.2% to 99.8%) (2,153/2,163 patients), and 93.9% (CI, 91.9% to 95.5%) (665/708 patients), respectively. Positive and negative likelihood ratios were 51.3 (CI, 38.1 to 69.0) and 0.015 (CI, 0.008 to 0.028), respectively. The overall rate of negative findings at appendectomy was 7.5% (CI, 5.8% to 9.7%) (54/716 patients), but would have decreased to 4.1% (28/690 patients) had surgery been avoided in 26 cases with true-negative findings on MDCT. The overall perforation rate was 17.8% (120/675 patients) but progressively decreased from 28.9% in 2000 to 11.5% in 2009. MDCT provided or suggested an alternative diagnosis in 893/2,122 patients (42.1%) without appendicitis or appendectomy.	3
44. Barger RL, Jr., Nandalur KR. Diagnostic performance of magnetic resonance imaging in the detection of appendicitis in adults: a meta-analysis. <i>Acad Radiol</i> 2010; 17(10):1211-1216.	Review/Other-Dx	8 articles; 363 total patients	To perform a meta-analysis evaluating the diagnostic performance of MRI for the diagnosis of acute appendicitis.	The inclusion criteria were fulfilled by 8 articles with a total of 363 patients (mean age 26.9 +/- 7.2 years; 86.2 % female). The appendix was not found in 8 patients, with one article not reporting such data. The summary sensitivity was 97% (92%-99% at 95% CI) and summary specificity was 95% (CI: 94%-99%), with a likelihood ratio+ of 16.3 (CI: 9.1-29.1) and a likelihood ratio- of 0.09 (CI: 0.04-0.197). Diagnostic odds ratio was 299.85 (CI: 97.5-921.61). No heterogeneity was found in the sensitivity (I(2) = 0.0, P=.4589). Minimal heterogeneity was found in the specificity (I(2) = 21.9%, P=.2553).	4
45. Cobben L, Groot I, Kingma L, Coerkamp E, Puylaert J, Blickman J. A simple MRI protocol in patients with clinically suspected appendicitis: results in 138 patients and effect on outcome of appendectomy. <i>Eur Radiol</i> 2009; 19(5):1175-1183.	Observational-Dx	138 patients	To establish the value of breathhold MRI in the diagnosis of acute appendicitis.	The resulting sensitivity and specificity were 100% and 99%, respectively. MRI can be a valuable and cost-effective tool in the workup of patients clinically suspected of having appendicitis.	2

\* See Last Page for Key

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
46. Heverhagen JT, Pfestroff K, Heverhagen AE, Klose KJ, Kessler K, Sitter H. Diagnostic accuracy of magnetic resonance imaging: a prospective evaluation of patients with suspected appendicitis (diamond). <i>J Magn Reson Imaging</i> 2012; 35(3):617-623.	Observational-Dx	52 patients	To show the effect of standard MRI in patients with suspected appendicitis on negative laparotomy and perforation rate in addition to evaluating the economic impact on hospital resources.	Negative laparotomy and perforation rate were 0% (0/52) and 8% (1/13). Sensitivity and specificity for detecting acute appendicitis were 85% (11/13) and 97% (38/39). In 40% of patients therapy changed due to the MRI. The overall effect on the use of hospital resources was a net saving of euro 2,335.	2
47. Mandeville K, Pottker T, Bulloch B, Liu J. Using appendicitis scores in the pediatric ED. <i>Am J Emerg Med</i> 2011; 29(9):972-977.	Observational-Dx	287 patients	To prospectively evaluate the Alvarado and Samuel (pediatric appendicitis score) appendicitis scoring systems in children and determine performance based on sex.	Patients with appendicitis had mean pediatric appendicitis score of 7.6, and those without had mean of 5.6 (P<.001). Patients with appendicitis had a mean Alvarado of 7.2, and those without had a mean of 5.2 (P<.001). In appendicitis patients, pediatric appendicitis score cutoff of 6 or greater would give 137 correct diagnoses; sensitivity, 88%; specificity, 50%; and PPV, 67%. An Alvarado cutoff of 7 or greater would give 118 correct diagnoses; sensitivity, 76%; specificity, 72%; and PPV, 76%. Both performed better in males than females.	3
48. Terasawa T, Blackmore CC, Bent S, Kohlwes RJ. Systematic review: computed tomography and ultrasonography to detect acute appendicitis in adults and adolescents. <i>Ann Intern Med</i> 2004; 141(7):537-546.	Review/Other-Dx	12 CT studies and 14 US studies	To review the diagnostic accuracy of CT and US in adults and adolescents with suspected acute appendicitis.	CT had sensitivity of 0.94 (95% CI, 0.91 to 0.95), a specificity of 0.95 (CI, 0.93 to 0.96), a positive likelihood ratio of 13.3 (CI, 9.9 to 17.9), and a negative likelihood ratio of 0.09. US had sensitivity of 0.86 (CI, 0.83 to 0.88), a specificity of 0.81, a positive likelihood ratio of 5.8, and a negative likelihood ratio of 0.19. CT is probably more accurate than US for diagnosing appendicitis in adults and adolescents.	4

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
49. Doria AS, Moineddin R, Kellenberger CJ, et al. US or CT for Diagnosis of Appendicitis in Children and Adults? A Meta-Analysis. <i>Radiology</i> 2006; 241(1):83-94.	Review/Other-Dx	Children: (26 studies, 9,356 patients); Adults (31 studies, 4,341 patients)	To perform a meta-analysis to evaluate the diagnostic performance of US and CT for the diagnosis of appendicitis in pediatric and adult populations.	Children: Sensitivity of 88% (95% CI: 86%, 90%) and specificity of 94% (95% CI: 92%, 95%), for US studies and sensitivity of 94% (95% CI: 92%, 97%) and specificity of 95% (95% CI: 94%, 97%) for CT studies. Adults: Pooled sensitivity and specificity for diagnosis were 83% (95% CI: 78%, 87%) and 93% (95% CI: 90%, 96%), respectively, for US studies and 94% (95% CI: 92%, 95%) and 94% (95% CI: 94%, 96%), respectively, for CT studies. CT had higher sensitivity and specificity than US. From a safety perspective, US should be considered initially in children.	4
50. Baldisserotto M, Marchiori E. Accuracy of noncompressive sonography of children with appendicitis according to the potential positions of the appendix. <i>AJR</i> 2000; 175(5):1387-1392.	Observational-Dx	425 patients	To evaluate noncompressive US of appendicitis in children according to the potential positions of the appendix.	Combined noncompressive and compressive techniques had a sensitivity of 98.5%, specificity of 98.2%, PPV 98.0% (99.9) and NPV 98.7% (97.2-100). The noncompressive technique is a valuable tool in US investigation of appendicitis.	3
51. Hahn HB, Hoepner FU, Kalle T, et al. Sonography of acute appendicitis in children: 7 years experience. <i>Pediatr Radiol</i> 1998; 28(3):147-151.	Observational-Dx	3,859 children	Prospective study to determine the accuracy of diagnosing appendicitis in children with high-resolution graded compression US.	494 had histologically proven acute or perforated appendicitis (prevalence 13%). In these children, sensitivity, specificity and overall accuracy of US were 90%, 97% and 96%, respectively. Clinical evaluation remains important because of false positive and negative sonograms.	3
52. Lessin MS, Chan M, Catalozzi M, et al. Selective use of ultrasonography for acute appendicitis in children. <i>Am J Surg</i> 1999; 177(3):193-196.	Observational-Dx	215 children	Prospective study to evaluate role of US in children with equivocal signs of acute appendicitis, and correlate with initial clinical impression and pathological findings.	Signs were unequivocal in 116 and equivocal in 99. In equivocal cases, sensitivity of the initial clinical impression vs US was 50% and 88%, respectively (P<0.05). Specificity was 85% and 96%, respectively. The PPV and NPV values improved from 63% to 90% and 78% to 94%, respectively, with the use of US. US may be useful if clinically equivocal.	3
53. Lowe LH, Draud KS, Hernanz-Schulman M, et al. Nonenhanced limited CT in children suspected of having appendicitis: prospective comparison of attending and resident interpretations. <i>Radiology</i> 2001; 221(3):755-759.	Observational-Dx	75 children	Prospective study to compare resident and attending radiologic interpretations of nonenhanced limited CT scans obtained in children suspected of having appendicitis.	Sensitivity, specificity, and accuracy of resident interpretations were 63%, 96%, and 88%, respectively, compared with those of attending interpretations of 95%, 98%, and 97%, respectively.	2

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
54. Schulte B, Beyer D, Kaiser C, Horsch S, Wiater A. Ultrasonography in suspected acute appendicitis in childhood-report of 1285 cases. <i>Eur J Ultrasound</i> 1998; 8(3):177-182.	Observational-Dx	1,285 children	Prospective study to compare the results of graded compression US with clinical and histological final diagnoses to determine the diagnostic value of real time US in children with acute appendicitis.	In diagnosis of acute appendicitis in childhood US achieves a sensitivity of 92%, specificity of 98%, a PPV of 90% and NPV of 98%. The overall accuracy was 98%. US is reliable.	3
55. Garcia Pena BM, Mandl KD, Kraus SJ, et al. Ultrasonography and limited computed tomography in the diagnosis and management of appendicitis in children. <i>JAMA</i> 1999; 282(11):1041-1046.	Observational-Dx	139 children and adolescents	Prospective study to determine the value of a protocol involving US and CT in the diagnosis and management of appendicitis in children and adolescents.	Protocol had a sensitivity of 94%, specificity of 94%, PPV of 90%, NPV of 97%, and accuracy of 94%. CT following a negative or indeterminate US result is highly accurate in the diagnosis of appendicitis in children.	3
56. Krishnamoorthi R, Ramarajan N, Wang NE, et al. Effectiveness of a staged US and CT protocol for the diagnosis of pediatric appendicitis: reducing radiation exposure in the age of ALARA. <i>Radiology</i> 2011; 259(1):231-239.	Observational-Dx	631 patients	To evaluate the effectiveness of a staged US and CT imaging protocol for the accurate diagnosis of suspected appendicitis in children and the opportunity for reducing the number of CT examinations and associated radiation exposure.	The sensitivity and specificity of the staged protocol were 98.6% and 90.6%, respectively. The negative appendectomy rate was 8.1% (19/235 patients), and the missed appendicitis rate was less than 0.5% (1/631 patients). CT was avoided in 333/631 patients (53%) in whom the protocol was followed and in whom the US findings were definitive.	3
57. Wan MJ, Krahn M, Ungar WJ, et al. Acute appendicitis in young children: cost-effectiveness of US versus CT in diagnosis--a Markov decision analytic model. <i>Radiology</i> 2009; 250(2):378-386.	Review/Other-Dx	N/A	To compare the cost-effectiveness of different imaging strategies in the diagnosis of pediatric appendicitis by using a decision analytic model.	The incremental cost-effectiveness ratio of US followed by CT to CT was <\$10,000 in both male and female patients. In a Markov-based decision model of pediatric appendicitis, the most cost-effective method of imaging pediatric appendicitis was to start with a US study and follow each negative US study with a CT examination.	4
58. Bachur RG, Hennelly K, Callahan MJ, Monuteaux MC. Advanced radiologic imaging for pediatric appendicitis, 2005-2009: trends and outcomes. <i>J Pediatr</i> 2012; 160(6):1034-1038.	Observational-Dx	55,238 children	To examine the variability in the use of CT and US for children with appendicitis and identify associations with clinical outcomes, and to demonstrate any trends in diagnostic imaging between 2005 and 2009.	Utilization of CT and US varied widely across institutions, with medians of 34% (IQR, 21%-49%) for CT and 6% (IQR, 2%-26%) for US. Increased use of US or a combination of CT and US (but not of CT use alone) was associated with a lower negative appendectomy rate. Imaging was not associated with other clinical outcomes. In children with appendicitis, the use of US has increased since 2007, whereas that of CT has decreased.	3

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
59. Kharbanda AB, Taylor GA, Bachur RG. Suspected appendicitis in children: rectal and intravenous contrast-enhanced versus intravenous contrast-enhanced CT. <i>Radiology</i> 2007; 243(2):520-526.	Observational-Dx	416 patients	To retrospectively compare the diagnostic performance of IV contrast material-enhanced CT with that of IV and rectal contrast-enhanced CT in the evaluation of children suspected of having appendicitis.	IV and rectal contrast-enhanced CT had a sensitivity of 92%, a specificity of 87% a NPV of 94%, and an accuracy of 89%. IV contrast-enhanced CT had a sensitivity of 93%, a specificity of 92%, a NPV of 95%, and an accuracy of 92%. There was no significant difference between the performance of IV contrast-enhanced CT and that of rectal and IV contrast-enhanced CT in children suspected of having appendicitis.	3
60. Kim YJ, Kim JE, Kim HS, Hwang HY. MDCT with coronal reconstruction: clinical benefit in evaluation of suspected acute appendicitis in pediatric patients. <i>AJR</i> 2009; 192(1):150-152.	Observational-Dx	61 patients	To assess the role of the addition of coronal reformatted images to MDCT in the evaluation of suspected acute appendicitis in pediatric patients.	In pediatric patients with suspected appendicitis, the addition of coronal reformatted scans to axial images in MDCT increases confidence in the diagnosis or exclusion of acute appendicitis.	3
61. Garcia K, Hernanz-Schulman M, Bennett DL, Morrow SE, Yu C, Kan JH. Suspected appendicitis in children: diagnostic importance of normal abdominopelvic CT findings with nonvisualized appendix. <i>Radiology</i> 2009; 250(2):531-537.	Observational-Dx	1,139 children	To determine whether lack of visualization of the appendix on otherwise normal abdominopelvic CT images can help exclude appendicitis in the pediatric population.	NPV of a normal CT examination in patients with a nonvisualized appendix was 98.7% (95% CI: 95.5%, 99.8%); that with a visualized appendix, 99.8% (95% CI: 98.7%, 99.99%); that with a partially visualized appendix, 100% (95% CI: 97.8%, 100%); and that with a fully visualized appendix, 99.6% (95% CI: 97.8%, 99.99%).	3
62. Johnson AK, Filippi CG, Andrews T, et al. Ultrafast 3-T MRI in the evaluation of children with acute lower abdominal pain for the detection of appendicitis. <i>AJR</i> 2012; 198(6):1424-1430.	Observational-Dx	42 patients	To evaluate the feasibility of ultrafast 3-T MRI in the evaluation of children with acute lower abdominal pain for the detection of appendicitis.	12/42 cases of acute appendicitis were detected with 100% sensitivity, 99% specificity, 100% NPV value, and 98% PPV, all of which were statistically significant (P<0.01). The pooled and individual receiver operating characteristic curves for radiologists' interpretation of the diagnosis of acute appendicitis were >0.95 in all cases (P<0.01).	1

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
63. Moore MM, Gustas CN, Choudhary AK, et al. MRI for clinically suspected pediatric appendicitis: an implemented program. <i>Pediatr Radiol</i> 2012; 42(9):1056-1063.	Observational-Dx	208 children	To describe the institution's development and the results of a fully implemented clinical program using MRI as the primary imaging evaluation for children with suspected appendicitis.	Diagnostic accuracy of MRI for pediatric appendicitis indicated a sensitivity of 97.6% (CI: 87.1%-99.9%), specificity 97.0% (CI: 93.2%-99.0%), PPV 88.9% (CI: 76.0%-96.3%), and NPV 99.4% (CI: 96.6%-99.9%). Time parameter analysis indicated clinical feasibility, with time requested to first sequence obtained mean of 78.7 +/- 52.5 min, median 65 min; first-to-last sequence time stamp mean 14.2 +/- 8.8 min, median 12 min; last sequence to report mean 57.4 +/- 35.2 min, median 46 min. Mean age was 11.2 +/- 3.6 years old. Girls represented 57% of patients.	3
64. Lim HK, Bae SH, Seo GS. Diagnosis of acute appendicitis in pregnant women: value of sonography. <i>AJR</i> 1992; 159(3):539-542.	Observational-Dx	45 patients	To assess the diagnostic value of US for appendicitis in pregnant women.	In 42 cases in which the imaging findings indicated the diagnosis, the overall sensitivity of US was 100%, the specificity was 96%, and the accuracy was 98%. US is as effective in pregnant women as in other patients with comparable statistical validity.	2
65. Lazarus E, Mayo-Smith WW, Mainiero MB, Spencer PK. CT in the evaluation of nontraumatic abdominal pain in pregnant women. <i>Radiology</i> 2007; 244(3):784-790.	Observational-Dx	78 patients	To retrospectively determine sensitivity and specificity of CT for the diagnosis of appendicitis in pregnant women with nontraumatic abdominal pain and retrospectively compare findings at CT and US in patients who underwent both examinations, with surgery or clinical follow-up as a reference standard.	CT findings established the diagnosis in 35% of examinations in pregnant women with abdominal pain (28/80), with a NPV of 99% for appendicitis; when CT followed negative US findings, CT findings established the diagnosis in 30% of patients.	3
66. Basaran A, Basaran M. Diagnosis of acute appendicitis during pregnancy: a systematic review. <i>Obstet Gynecol Surv</i> 2009; 64(7):481-488; quiz 499.	Review/Other-Dx	3 articles on CT; 5 articles on MRI	To perform a systematic review to evaluate the diagnostic performance of CT and MRI for the diagnosis of appendicitis in pregnancy.	The pooled estimates of sensitivity and specificity, positive and negative likelihood ratios for the performance of CT in patients with prior normal/inconclusive US result were 85.7% and 97.4%, 10.1 and 0.21, respectively. The pooled estimates for performance of MRI in patients were 80% and 99%, 22.7, and 0.29, respectively. Despite the limitations of this study, CT and MRI seem to be highly sensitive and specific for the diagnosis of appendicitis in pregnancy and their use should be considered when the results of US are normal or inconclusive, and appendicitis is suspected.	4

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
67. Israel GM, Malguria N, McCarthy S, Copel J, Weinreb J. MRI vs. ultrasound for suspected appendicitis during pregnancy. <i>J Magn Reson Imaging</i> 2008; 28(2):428-433.	Observational-Dx	33 patients	To compare the sensitivity, specificity, PPV, and NPV of US and MRI in evaluation of pregnant patients with a clinical suspicion of appendicitis.	When the appendix was visualized at MRI, the sensitivity, specificity, PPV, and NPV for the diagnosis of appendicitis was 100% for all parameters. When the appendix was visualized at US, the sensitivity, specificity, PPV, and NPV for the diagnosis of appendicitis was 50%, 100%, 100%, and 66%, respectively. Based on a relatively small number of true-positives, the data suggests that MRI is very useful for the diagnosis and exclusion of appendicitis in pregnant women.	3
68. Oto A, Ernst RD, Ghulmiyyah LM, et al. MR imaging in the triage of pregnant patients with acute abdominal and pelvic pain. <i>Abdom Imaging</i> 2009; 34(2):243-250.	Observational-Dx	118 patients	To retrospectively assess the performance of MRI in the evaluation and triage of pregnant patients presenting with acute abdominal or pelvic pain.	The sensitivity, specificity, accuracy, PPV and NPV of MRI for acute appendicitis, and surgical/ interventional diagnoses were 90.0% vs 88.9%, 98.1% vs 95.0%, 97.5% vs 94.1%, 81.8% vs 76.2%, 99.1% vs 97.9%, respectively. MRI is useful for triage of pregnant patients with acute abdominal and pelvic pain.	3
69. Pedrosa I, Levine D, Eyvazzadeh AD, Siewert B, Ngo L, Rofsky NM. MR imaging evaluation of acute appendicitis in pregnancy. <i>Radiology</i> 2006; 238(3):891-899.	Observational-Dx	51 patients	To determine accuracy of MRI in pregnant patients with non-visualization of the appendix with US.	MRI 100% accurate and 94% specific. Only 4 patients had appendicitis.	3
70. Blumenfeld YJ, Wong AE, Jafari A, Barth RA, El-Sayed YY. MR imaging in cases of antenatal suspected appendicitis--a meta-analysis. <i>J Matern Fetal Neonatal Med</i> 2011; 24(3):485-488.	Review/Other-Dx	229 patients	To perform a meta-analysis of recently published data regarding the utility of MRI in cases of antenatal suspected acute appendicitis.	In the first analysis in which nondiagnostic scans were excluded, the sensitivity, specificity, PPV and NPV of MRI for diagnosing appendicitis were 95.0%, 99.9%, 90.4%, and 99.5%, respectively. In the second analysis, which included nondiagnostic scans, the sensitivity, specificity, PPV and NPV were 90.5%, 98.6%, 86.3%, and 99.0%, respectively.	4

**Right Lower Quadrant Pain-Suspected Appendicitis  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
71. Pedrosa I, Lafornera M, Pandharipande PV, Goldsmith JD, Rofsky NM. Pregnant patients suspected of having acute appendicitis: effect of MR imaging on negative laparotomy rate and appendiceal perforation rate. <i>Radiology</i> 2009; 250(3):749-757.	Observational-Dx	148; Mean gestational age, 20 weeks	To investigate the effect of MRI on the negative laparotomy rate and the perforation rate in pregnant patients suspected of having acute appendicitis and to assess the need for CT in this setting.	MRI results were positive in all 14 (10%) patients with acute appendicitis. MRI results were negative in 125/134 patients without acute appendicitis; there were 9 false-positive cases (2 positive, 7 inconclusive). Among the patients without acute appendicitis, the normal appendix could be visualized on MRI in 87% (116/134) of cases (P<.0001). 27 (18%) patients underwent surgical exploration, and 8 of them had negative laparotomy results, yielding a negative laparotomy rate of 30% and a perforation rate of 21% (3/14 patients). Only 4 (3%) patients underwent CT. For pregnant patients clinically suspected of having acute appendicitis, use of MRI yields favorable combinations of negative laparotomy rate and perforation rate compared with previously reported values. The radiation exposure associated with CT examination can be avoided in most cases.	3
72. Foley CR, Latimer RG, Rimkus DS. Detection of acute appendicitis by technetium 99 HMPAO scanning. <i>Am Surg</i> 1992; 58(12):761-765.	Observational-Dx	30 patients	Prospective study to report use of Tc-99 HMPAO scanning in acute appendicitis.	Tc-99 HMPAO study had a sensitivity of 81%, a specificity of 100% and an overall accuracy of 89%. Tc-99 HMPAO WBC scanning is useful in confirming clinical diagnosis of acute appendicitis.	3
73. Stewart D, Grewal N, Choi R, Waxman K. The use of tagged white blood cell scans to diagnose appendicitis in pregnant patients. <i>Am Surg</i> 2006; 72(10):894-896.	Observational-Dx	13 patients	A retrospective review of all patients who were pregnant and underwent a nuclear medicine study as part of their evaluation was performed.	There was no relationship between the results of Tc-99m tagged WBC scans and the presence of appendicitis (P=0.538). The sensitivity of the Tc-99m tagged WBC scans was 50 %; specificity was 73 %. The data suggest that Tc-99m tagged WBC scans in pregnancy is not reliable in evaluating for appendicitis.	3
74. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: <a href="http://www.acr.org/~link.aspx?id=29C40D1FE0EC4E5EAB6861BD213793E5&amp;amp; z=z">http://www.acr.org/~link.aspx?id=29C40D1FE0EC4E5EAB6861BD213793E5&amp;amp; z=z</a> .	Review/Other-Dx	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	4

## Evidence Table Key

### Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  - c) the study is an expert opinion or consensus document.

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Dx = Diagnostic

Tx = Treatment

## Abbreviations Key

CI = Confidence interval

CT = Computed tomography

HMPAO = Hexamethyl-propylamine-oxime

IV = Intravenous

MDCT = Multidetector computed tomography

MRI = Magnetic resonance imaging

NPV = Negative predictive value

PPV = Positive predictive value

US = Ultrasound

WBC = White blood cell