American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Right Lower Quadrant Pain**

Variant 1: **Fever, leukocytosis, and classic presentation clinically for appendicitis in adults.**

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	8		High
US abdomen RLQ graded compression	6		None
CT abdomen and pelvis without contrast	6		High
X-ray chest	5		Min
US pelvis transabdominal and transvaginal	5		None
X-ray abdomen supine and upright	5		Low
X-ray colon barium enema double-contrast	4		Med
X-ray colon barium enema single-contrast	4		Med
MRI abdomen and pelvis	4		None
X-ray small bowel series with barium	3		Low
NUC gallium scan abdomen	3		High
NUC WBC scan abdomen pelvis	3		Med
X-ray small bowel enteroclysis	2		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Clinical Condition: **Right Lower Quadrant Pain**

Variant 2: **Fever, leukocytosis; possible appendicitis, atypical presentation, adults and adolescents.**

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	8		High
X-ray abdomen supine and upright	6		Low
US abdomen RLQ graded compression	6		None
US pelvis transabdominal and transvaginal	6		None
CT abdomen and pelvis without contrast	6		High
X-ray chest	5		Min
X-ray colon barium enema double-contrast	5		Med
X-ray colon barium enema single-contrast	5		Med
MRI abdomen and pelvis	5		None
X-ray small bowel series with barium	4		Low
NUC gallium scan abdomen	3		High
NUC WBC scan abdomen pelvis	3		Med
X-ray small bowel enteroclysis	2		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Clinical Condition: **Right Lower Quadrant Pain**

Variant 3: **Fever, leukocytosis, pregnant woman.**

Radiologic Procedure	Rating	Comments	RRL*
US abdomen RLQ graded compression	8		None
MRI abdomen and pelvis	7		None
US pelvis transabdominal and transvaginal	6		None
CT abdomen and pelvis with contrast	6		High
CT abdomen and pelvis without contrast	5		High
X-ray chest	4		Min
X-ray abdomen supine and upright	2		Low
X-ray colon barium enema double-contrast	2		Med
X-ray small bowel enteroclysis	2		Med
X-ray colon barium enema single-contrast	2		Med
NUC WBC scan abdomen pelvis	2		Med
X-ray small bowel series with barium	2		Low
NUC gallium scan abdomen	2		High
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Clinical Condition: **Right Lower Quadrant Pain**

Variant 4: **Fever, leukocytosis, possible appendicitis, atypical presentation in children (less than 14 years of age).**

Radiologic Procedure	Rating	Comments	RRL*
US abdomen RLQ graded compression	8		None
CT abdomen and pelvis with contrast	7	May be useful following negative US.	High
X-ray abdomen supine and upright	6		Low
US pelvis transabdominal and transvaginal	5		None
X-ray chest	5		Min
CT abdomen and pelvis without contrast	5		High
MRI abdomen and pelvis	5		None
X-ray colon barium enema single-contrast	3		Med
X-ray colon barium enema double-contrast	3		Med
X-ray small bowel series with barium	3		Low
NUC gallium scan abdomen	2		High
X-ray small bowel enteroclysis	2		Med
NUC WBC scan abdomen pelvis	2		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

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Summary of Literature Review

Few comparative imaging studies evaluating right lower quadrant pain are available. Most imaging reports center on disease processes, such as appendicitis. Because appendicitis is the most common cause of right lower quadrant pain, the focus of this narrative is on appendicitis and the accuracy of imaging procedures in diagnosing appendicitis, although consideration of other diseases is, of course, included.

Acute appendicitis is the most common acute abdominal disorder that requires surgery. In most patients with acute appendicitis, imaging may not be necessary, because the clinical presentation is sufficiently diagnostic to allow surgery. To date, however, no prediction rules for identifying subjects with appendicitis have been validated. In the published studies for imaging in appendicitis, the selection criteria for imaging are not often stated, but in most investigations, subjects with definitive clinical exam findings of appendicitis undergo operation without imaging. In the reported imaging studies, an average of 45%-50% of imaged subjects had appendicitis, and 36% had nonspecific abdominal pain. Data on the overall effect of imaging on surgical treatment of appendicitis and patient outcome remain contradictory.

Plain film diagnosis is of limited value evaluating acute appendicitis, except in occasional circumstances when an appendicolith or other ancillary findings are identified. Although barium enema has been used historically to diagnose appendicitis, it depends on the negative finding of nonvisualization of the appendix and may be quite uncomfortable in patients with acute appendicitis. Nonetheless, barium small-bowel follow-through or barium enema may be useful for other causes of right lower quadrant pain, including suspected small bowel obstruction, infectious ileitis, and inflammatory bowel disease. Finally, use of MRI for appendicitis has been reported in a few small case series, including in pregnant women.

Computed tomography (CT) is the most accurate study for evaluating patients without a clear clinical diagnosis of acute appendicitis. In a meta-analysis of prospective studies of the accuracy of CT and ultrasonography in adolescents and adults, CT demonstrated superior sensitivity (0.94, 95% CI: 0.91 to 0.95) and specificity (0.95, 95% CI: 0.93 to 0.96) versus ultrasound (US) (sensitivity 0.86, 95% CI: 0.83 to 0.88; specificity 0.81, 95% CI: 0.78 to 0.84). This analysis was based on 12 studies of CT and 14 studies of US identified through December 2003, and included four studies that directly compared both modalities. The results of investigations of CT showed consistent results across all studies and institutions, while US investigations demonstrated heterogeneity, suggesting greater dependence on operator skill.

Another controversy is whether or not to use intravenous contrast in the CT evaluation of appendicitis. High accuracy has been reported for both techniques, and direct comparisons are lacking. However, the majority of the available evidence is on CT with intravenous contrast. Institutional experience may be the best determinant appropriateness of intravenous contrast. Both CT and US may be effective in detecting causes of pain unrelated to appendicitis. CT has been reported to show a non-appendicitis cause of abdominal pain in 20% of subjects, versus 15% for US. The range of diseases studied includes inflammatory bowel disease, infectious bowel disease, small bowel obstruction, acute gynecological conditions and others.

CT appears superior to sonography in evaluating patients with periappendiceal abscess, especially when the abscesses become large. CT can be used to choose among different therapeutic options, including antibiotic treatment (with small abscesses), percutaneous drainage (with one to three well-defined medium-sized abscesses), and surgery (with extensive abnormality not amenable to percutaneous drainage).

CT and US have been less well evaluated in children than in adults. Many large prospective studies include subjects of all ages, despite the potential differences in imaging accuracy between children and adults due to smaller body size and less body fat in children. This makes it difficult

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to determine the accuracy of imaging in different subgroups. Further, the increased radiosensitivity of children makes the use of ionizing radiation of more concern for them. A systematic literature review through July 2004 revealed eight prospective evaluations of US for appendicitis in children. The pooled sensitivity of graded compression US was 91% (95% CI: 89%-93%), and the specificity was 97% (95% CI: 95%-99%). Only a single prospective study of CT in children was identified, reporting a sensitivity of 95%, and specificity of 98%. There is also a small literature on use of US as an initial imaging study, followed by CT for equivocal cases. Such combined protocols demonstrate sensitivity of 95% (95% CI: 83%-100%), and specificity 93% (95% CI: 87%-97%). These results suggest that although CT is more accurate, US may also be appropriate in experienced hands, particularly if equivocal results are followed up by CT.

Nuclear medicine imaging with WBC scans has also been reported for evaluating right lower quadrant pain.

Evaluation of the accuracy of imaging in pregnant women has received little attention in the literature. In general, ionizing radiation from CT should be avoided during pregnancy, and US is clearly a safer imaging option. However, with the absence of evidence, no specific recommendation can be made.

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