IMAGING FOR RIGHT LOWER QUADRANT PAIN

Introduction
Right lower quadrant (RLQ) pain is an extremely common presentation for patients in emergency rooms and doctors’ offices. Besides pain, the typical associated symptoms are very nonspecific, including nausea, vomiting, leukocytosis, fever, etc. Once a thorough history and physical exam have been performed, differential considerations begin to form based on those data as well as demographics. Occasionally, sufficient information is provided by the clinical picture for firm diagnosis and confident therapy. More often than not, however, the spectrum of differential considerations is sufficiently broad and impactful on therapy that additional tools are needed for proper patient management. This typically means medical imaging.

Imaging in RLQ pain comes in several different modalities, some more and some less useful than others. The right tool for the job will often depend on the type of patient and their individual presentation. There is often not a “one-size-fits-all” approach that can be universally applied. This is an issue that has been addressed on many fronts, including having been tackled by the American College of Radiology, which has published appropriateness criteria for different imaging studies in RLQ pain. Clinical tools are also available to guide and assist in the work-up of RLQ pain, such as the Alvarado scale in predicting and identifying patients with acute appendicitis. The accuracy of these has been shown to be inferior to imaging, however.¹

Differential considerations for RLQ pain often start with acute appendicitis. This is the most common cause of RLQ pain and is the most common acute abdominal disorder requiring surgery. The list of other considerations is quite long and varies from the extremely benign to life threatening. As this is a newsletter, only a few of the most common disorders will be addressed in these pages.

Acute Appendicitis
As stated, this is an extremely common problem faced by patients and their treating physicians. Once the decision has been made to pursue imaging, what next? Which is the best test to order in terms of sensitivity and specificity, but not forgetting other important considerations such as cost, radiation exposure, timeliness of results, etc? The ACR appropriateness criteria for RLQ pain (table 1) are useful and illuminating in this application. Radiography and fluoroscopy (barium enema) have very limited utility in this problem. Computed tomography (CT) and ultrasound (US) are truly the workhorses...
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for this disorder with special applications of magnetic resonance imaging (MRI).

In adolescents and adults, CT has been shown to have a clear edge over US with both higher sensitivity (91% vs. 78%) and specificity (90% vs. 85%)². Technical issues are much larger with US and more difficult to overcome. This makes CT the first line imaging choice in this patient population (table 1, variants 1 and 2). Particularly with the availability of multidetector CT providing sagittal and coronal reformats without any additional irradiation, this test will most often provide a diagnosis for this presentation. CT is also able to offer much information about alternative disorders that may mimic acute appendicitis and can often provide additional detail for planned intervention. Our preferred CT protocol is to include IV and oral contrast whenever possible. Contrast should only be eliminated in cases of contrast allergies or situations where severe time constraints (ER cases). Unenhanced CT scans are less sensitive but still generally useful in evaluating RLQ pain.

Pediatrics and Pregnancy

In imaging for acute appendicitis, special considerations exist for two patient populations: pediatric age patients and pregnant women. In pediatric age groups, CT maintains the edge in terms of both sensitivity and specificity. However, with the added importance of greater radiosensitivity, US with its absence of ionizing radiation is the first line imaging choice in the pediatric population, especially with follow-up CT in equivocal cases. The CT-after-US approach has a reported sensitivity and specificity of 94%³. Additionally, a recent study shows high negative predictive value in cases where the appendix is not visible (98.7%)⁴. (Table 1 – Variant 4) In children, CT for RLQ pain less than 24

Table 1 - American College of Radiology - ACR Appropriateness Criteria

<table>
<thead>
<tr>
<th>Clinical Condition: Right Lower Quadrant Pain — Suspected Appendicitis</th>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variant 1</td>
<td></td>
<td>CT abdomen and pelvis with contrast</td>
<td>8</td>
<td>Use of oral or rectal contrast depends on institutional preference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CT abdomen and pelvis without contrast</td>
<td>7</td>
<td>Use of oral or rectal contrast depends on institutional preference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US abdomen RLQ</td>
<td>6</td>
<td>With graded compression</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US pelvis</td>
<td>5</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X-ray abdomen</td>
<td>5</td>
<td>May be useful in excluding free air or obstruction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MRI abdomen and pelvis with or without contrast</td>
<td>4</td>
<td>See statement regarding contrast in text under “Anticipated Exceptions.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X-ray contrast enema</td>
<td>3</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tc-99m WBC scan abdomen and pelvis</td>
<td>3</td>
<td>O</td>
</tr>
</tbody>
</table>

**Comments**

- **Rating Scale:** 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate *Relative Radiation Level

**Table 1**: Imaging for acute appendicitis. (left) shows a typical thickened and inflamed appendix. A coronal image from a different patient (right) shows similar findings in addition to an appendicolith.
For pregnant patients, avoiding ionizing radiation is of even greater importance and therefore US is again the preferred initial modality. Although CT following equivocal US has been shown to be effective (sensitivity of 86% and specificity of 97%), MRI which does not utilize radiation shows similar results (sensitivity of 80% and specificity of 99%) and is the preferred follow-up examination after inconclusive US (Figure 4). MRI imaging can be performed without the need for oral or IV contrast agents. (Table 1 – Variant 3)

**Differential Diagnosis**

Again, many different etiologies can present with similar physical and historical findings. Some of the more common problems with an associated finding are listed below:

- **Mesenteric Adenitis**: Nonspecific inflammatory lymph node response to systemic infection. Presents with abdominal pain, malaise, lethargy, and sometimes fever. Usually not a primary indication for imaging, but often identified incidentally.

- **Diverticulitis**: Most frequently in the left lower quadrant, but not infrequently presenting on the right. Disease prevalence increases with patient age. CT is the preferred imaging modality.

- **Inflammatory/Infectious Bowel Disease**: Crohn’s disease can involve any portion of the GI tract, but has a certain predilection of the terminal ileum (curved arrow) in the right lower quadrant. Several infectious diseases will also preferentially involve this portion of small bowel and the cecum (straight arrow). CT is the preferred imaging modality.

- **Ovarian Cysts**: Frequent cause of pain in younger women, even in premenarchal girls. Signs and symptoms of infection are typically absent. US is the first line imaging modality. CT and MRI can be used for further evaluation.

- **Ureterolithiasis/Urethopathy**: Right sided ureterolithiasis often presents with RLQ pain, often associated with flank pain. CT is the best modality to detect these stones and look for other urinary tract abnormalities. Pyelonephritis can cause similar symptoms and often will not be visible with imaging.

- **Ectopic Pregnancy**: US evaluation should be used to confirm an intrauterine pregnancy in pregnant females presenting with RLQ pain. If absent, ectopic pregnancy must be considered.
Meet Our Radiologists

Matthew A. McNairy, M.D.
Dr. Matthew A. McNairy’s professional areas of interest are musculoskeletal radiology and breast imaging. He is fellowship trained in musculoskeletal radiology and co-chairs sports medicine and musculoskeletal conferences at the Utah Valley Regional Medical Center. He is also fellowship trained in breast imaging and specializes in breast cancer diagnosis using mammography, ultrasound and MRI.

After graduating Magna Cum Laude in his undergraduate work at Brigham Young University, Dr. McNairy attended the University of California, San Diego School of Medicine. Following medical school, he did his residency at the University of New Mexico Health Sciences Center and earned board certification in diagnostic radiology. He then completed two fellowships at the University of California, San Diego, one in musculoskeletal radiology and one in breast imaging. His professional associations include the Radiological Society of North America, the American College of Radiology, and the American Medical Society.

J. Daniel Rasband, M.D.
An early interest in anatomy combined with Dr. J. Daniel Rasband’s desire to be actively involved with physicians of all types in the diagnosis of disease led to an easy fit within this discipline.

After graduating from medical school at the University of Rochester School of Medicine and Dentistry in New York, Dr. Rasband completed a transitional medicine internship at the LDS Hospital. This was followed by a residency in diagnostic radiology at the University of Utah. Dr. Rasband’s primary training is in general diagnostic radiology, with skill in interpreting many different imaging modalities, including MRI, CT, ultrasound, and general radiography. Following residency, Dr. Rasband pursued further training at Duke University Medical Center with a fellowship in nuclear radiology.

Dr. Rasband’s particular area of interest and expertise is in positron emission tomography (PET) combined with CT. Oncology is the primary use for this imaging modality. His professional associations include the Radiological Society of North America, the American College of Radiology, and the Society of Nuclear Medicine.