American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Right Upper Quadrant Pain**

Variant 1: **Fever, elevated WBC, positive Murphy sign.**

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	8		None
NUC cholescintigraphy	6	May use either nuclear medicine exam or ultrasound exam.	Low
X-ray upper GI series	4		Low
X-ray abdomen	4		Low
X-ray colon barium enema	4		Med
CT abdomen	4		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 2: **Fever, elevated WBC, positive Murphy sign, normal gallbladder ultrasound.**

Radiologic Procedure	Rating	Comments	RRL*
NUC cholescintigraphy	8		Low
CT abdomen	6		Med
X-ray abdomen	6		Low
X-ray upper GI series	6		Low
US abdomen repeat within 24 hours	4		None
X-ray colon barium enema	3		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 3: **No fever, normal WBC.**

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	8		None
CT abdomen	7		Med
NUC cholescintigraphy	6		Low
X-ray upper GI series	6		Low
X-ray abdomen	4		Low
X-ray colon barium enema	4		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Clinical Condition: **Right Upper Quadrant Pain**

Variant 4: **No fever, normal WBC, ultrasound shows only gallstones.**

Radiologic Procedure	Rating	Comments	RRL*
NUC cholescintigraphy	8		Low
X-ray upper GI series	6		Low
CT abdomen	6		Med
X-ray abdomen	4		Low
X-ray colon barium enema	4		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 5: **Hospitalized patient with fever, elevated WBC, and positive Murphy sign.**

Radiologic Procedure	Rating	Comments	RRL*
US abdomen	8		None
NUC cholescintigraphy	7		Low
CT abdomen	7		Med
X-ray abdomen	6		Low
NUC cholescintigraphy with cholecystokinin	6		Low
US abdomen with cholecystokinin	5		None
INV cholangiography percutaneous cholecystostomy	5	Particularly in ICU patients, this can be both diagnostic and therapeutic.	IP
X-ray colon barium enema	4		Med
X-ray upper GI series	4		Low
INV ERCP	3		IP
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Expert Panel on Gastrointestinal Imaging: Robert L. Bree, MD, MHSA[1]; W. Dennis Foley, MD[2]; Spencer B. Gay, MD[3]; Seth N. Glick, MD[4]; Jay P. Heiken, MD[5]; James E. Huprich, MD[6]; Marc S. Levine, MD[7]; Pablo R. Ros, MD, MPH[8]; Max Paul Rosen, MD, MPH[9]; William P. Shuman, MD[10]; Frederick L. Greene, MD[11]; Don C. Rockey, MD.[12]

Summary of Literature Review

Acute right upper quadrant pain is a very common presenting symptom in patients presenting to hospital emergency rooms and in the occasional patient hospitalized for chronic disease or trauma. The primary diagnosis to be established in these patients is acute cholecystitis (AC), and the primary mode of treatment is laparoscopic cholecystectomy. It has been suggested empirically and by scientific evidence that approximately one-third of patients with presumptive diagnosis of AC will not be confirmed as AC on follow-up. Of patients who have surgery for AC, 20%-25% may have a different diagnosis. These studies, of course, were primarily performed in the era before modern imaging. Additionally, because there are data indicating that surgery in AC leads to better outcomes, there is preference among surgeons to make a diagnosis based on the presence of gallstones and clinical findings and perform early laparoscopic cholecystectomy. In fact, it might be necessary to redefine the patient outcomes of AC rather than rely on strict histologic criteria when, in the early stages of the disease, the histologic abnormalities may be minimal. In the otherwise healthy patient, imaging intervention may be only minimally necessary, but in more complicated patients a more complex protocol might be appropriate [1-3].

The evidence-based diagnosis of AC was studied in a meta-analysis published in 2003. No clinical or laboratory finding had a high or low enough likelihood ratio to predict its presence or absence. This study further supports the evidence that imaging studies are essential for the diagnosis [4]. Much of the literature defining the role of imaging studies in evaluating patients with acute right upper quadrant pain is from the 1980s. When ultrasound (US) began to be used for these patients, it became obvious that it was destined to replace intravenous cholangiography and oral cholecystography for gallbladder evaluation. An initial study in 1981 defined the sonographic Murphy sign as focal gallbladder tenderness, which, along with sludge and gallbladder thickening, was able to separate acute from chronic cholecystitis in patients who harbored stones [5]. Unfortunately, the sonographic Murphy sign does have a low specificity for AC [6].

In 1982, the accuracy of scintigraphy with HIDA compared with sonography indicated similar excellent results in 91 patients suspected of having AC. The overall accuracy of US was 88%, and for scintigraphy, it was 85% [7].

A study of 194 patients published in 1983 used strict criteria for pathologic diagnosis of AC and liberal US diagnosis (presence of stones) showed that, when scintigraphy was compared with US, sensitivities were high for both but specificity of US dropped to 64% with a positive predictive value of only 40%. The sonographic Murphy sign was not analyzed, nor was there correlation with clinical data [8].

Since these studies, other scattered articles in the radiologic literature have debated the role of US and scintigraphy in the diagnosis of AC. One criticism of scintigraphy is the time to perform the study (up to 4 hours to separate acute from chronic cholecystitis). The time can be diminished with the use of IV morphine, but the yield in otherwise healthy patients may not be significant because they will have the same outcome, a laparoscopic cholecystectomy. Some may argue that AC should be defined by the relief of symptoms following cholecystectomy. Authors often recommend US or scintigraphy, or both, for diagnosing AC; however, it is accepted that scintigraphy continues to have higher sensitivity and specificity than US. The role of scintigraphy remains for the individual surgeon or emergency physician to determine in an individual case [7-11].

Complications of AC include gangrene, empyema, and perforation. The sonographic Murphy sign may be absent when gangrenous AC is present, and other features such as pericholecystic fluid, gallbladder wall thickening, and dilated gallbladder are important in this group of patients (12).

With the routine use of laparoscopic cholecystectomy, the importance of preoperative or intraoperative detection of nonobstructing, asymptomatic common duct stones remains controversial. Common duct stones are present in

[1]Principal Author and Panel Chair, Radia Medical Imaging, Everett, Wash; [2]Froedtert Hospital East, Milwaukee, Wis; [3]University of Virginia Health Science Center, Charlottesville, Va; [4]Presbyterian Medical Center, Philadelphia, Pa; [5]Mallinckrodt Institute of Radiology, St. Louis, Mo; [6]Mayo Clinic, Rochester, Minn; [7]Hospital of the University of Pennsylvania, Philadelphia, Pa; [8]Brigham & Women's Hospital, Boston, Mass; [9]Beth Israel Hospital, Boston, Mass; [10]University of Washington, Seattle, Wash; [11]Carolinas Medical Center, Charlotte, NC, American College of Surgeons; [12]University of Texas, Southwest Medical Center, Dallas, Texas, American Gastroenterological Association.

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

10%-20% of patients with AC. One approach to predicting common duct stones uses the size of the gallstones present, with patients having multiple stones less than 5 mm in diameter more likely to have common duct stones than those with multiple larger stones or single large stones [13]. In patients at higher risk for common duct stones, preoperative study with ERCP may be warranted [14].

The patient with acalculous cholecystitis is more problematic. The use of sonography and scintigraphy has been advocated, including using cholecystokinin to attempt to evaluate gallbladder contraction [15]. The absence of stones, particularly in the patient presenting to the emergency room, should be confirmed with a follow-up examination if symptoms persist. Otherwise, acalculous cholecystitis seen in hospitalized patients as well as in a small percentage of patients presenting to the emergency room may be a diagnosis of exclusion. Computed tomography (CT) has a role in evaluating these critically ill patients [16]. In the patient in the intensive care unit, several centers perform percutaneous cholecystostomies. Others are less aggressive, or cholecystostomies are performed surgically.

Other clinical conditions that can simulate AC and present with acute right upper quadrant pain include chronic cholecystitis, peptic ulcer, pancreatitis, gastroenteritis, bowel obstruction, and many others. In this group of patients, barium studies of the upper and lower gastrointestinal tract can be useful to identify alternative diagnoses.

In summary, the diagnosis of AC can often be made clinically, with confirmation of gallstones necessary to confirm the need for laparoscopic cholecystectomy. A study has yet to be performed that relates cholecystectomy performed with this scenario to patient outcomes. Scintigraphy costs more, takes longer, and gives higher sensitivity and specificity than US, but it cannot contribute to a diagnosis if the etiology is not within the biliary tract. False positives can occur in patients with high bilirubin levels and severe intercurrent illnesses. False negatives are rare in AC. These guidelines should allow the radiologist, emergency physician, and surgeon to be comfortable in choosing an expedient modality or combination of modalities to make this important diagnosis.

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