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Abdominal ultrasound *versus* hepato-imino diacetic acid scan in diagnosing acute cholecystitis—what is the real benefit?

Christodoulos Kaoutzanis, MD,[a,*] *Eric Davies, MD,*[a] *Stefan W. Leichtle, MD,*[a] *Kathleen B. Welch, MS, MPH,*[b] *Suzanne Winter, MS,*[a] *Richard M. Lampman, PhD,*[a] *and Wallace Arneson, MD*[a]

[a] *Department of Surgery, Saint Joseph Mercy Health System, Ann Arbor, Michigan*
[b] *Center for Statistical Consultation and Research, University of Michigan, Ann Arbor, Michigan*

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ABSTRACT

Background: Acute cholecystitis is one of the most common surgical problems, yet substantial debate remains over the utility of simple examination, abdominal ultrasound (AUS), or advanced imaging such as hepato-imino diacetic acid (HIDA) scan to support the diagnosis.

Materials and methods: The preoperative diagnostic workup of patients who underwent cholecystectomy with histologically confirmed acute cholecystitis was reviewed to calculate the sensitivity of AUS, HIDA scan, or both. In addition, the sensitivity of the commonly described ultrasonographic findings was assessed.

Results: From 2010 through 2012, 406 patients among 9087 reviewed charts presented to the emergency department with acute upper abdominal pain and met inclusion criteria. 32.5% ($N = 132$) of patients underwent AUS only, 11.3% ($N = 46$) underwent HIDA scan only, and 56.2% ($N = 228$) had both studies performed for workup. 52.7% ($N = 214$) of patients had histopathologically confirmed acute cholecystitis. The sensitivities of AUS, HIDA, and AUS combined with HIDA for acute cholecystitis were 73.3% (95% confidence interval [CI] = 66.3%–79.5%), 91.7% (95% CI = 86.2%–95.5%), and 97.7% (95% CI = 93.4%–99.5%), respectively. Although of limited sensitivity, AUS findings of sonographic Murphy sign, gallbladder distension, and gallbladder wall thickening were associated with a diagnosis of acute cholecystitis.

Conclusions: The sensitivity of AUS for diagnosing acute cholecystitis in patients with acute upper abdominal pain is limited. The addition of a HIDA scan in the diagnostic workup significantly improves sensitivity and can add valuable information in the appropriate clinical setting.

* *Corresponding author*. Department of Surgery, Saint Joseph Mercy Health System, 5333 McAuley Drive, Reichert Health Building, Suite R-2111, Ann Arbor, MI 48106. Tel.: +1 734 834 0597; fax: +1 734 712 2809.
E-mail address: ckaoutzanis@gmail.com (C. Kaoutzanis).
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1. Introduction

Ten to twenty percent of Americans have gallstones, and each year up to 3% of them experience symptoms of biliary colic [1,2]. Acute cholecystitis will develop in about 20% of this patient population [3]. The overwhelming majority of those will present to the Emergency Department with complaints of upper abdominal pain. Accurate diagnosis in a timely fashion is essential to initiate treatment and prevent unnecessary morbidity and mortality. Despite a thorough history and physical examination by experienced physicians, the diagnosis is frequently ambiguous requiring more comprehensive and at times laborious diagnostic imaging evaluation. A recent clinical review in the Journal of the American Medical Association concluded that no single clinical finding or laboratory test carries sufficient weight to establish or exclude acute cholecystitis without further testing [4].

Several investigators have previously examined the role of abdominal ultrasound (AUS) in the diagnosis of acute cholecystitis [5–7]. Multiple sonographic indicators for acute cholecystitis have been described including the presence of gallstones, gallbladder wall thickening, gallbladder distension, pericholecystic fluid, and a sonographic Murphy sign [8–10]. However, the impact of different combinations of ultrasonographic findings on the diagnosis of acute cholecystitis has not been established. Hepato-imino diacetic acid (HIDA) scan is a well-established scintigraphic technique that is used as an alternative or complementary modality for the diagnosis of acute cholecystitis. Although it has been shown to have higher sensitivity, specificity, and diagnostic accuracy when compared with ultrasonography, the individual studies contain a small number of subjects [7,11]. Furthermore, despite the superior sensitivity of HIDA scan for the diagnosis of acute cholecystitis, physicians seem to be reluctant to use HIDA scan, and ultrasonography continues to be the most commonly used imaging modality for suspected cholecystitis.

The aim of this study was to determine the sensitivity of AUS, HIDA scan, and the combination of both studies for acute cholecystitis in a selected patient population who presented to the Emergency Department with acute upper abdominal pain and suspected diagnosis of acute cholecystitis, and who later underwent cholecystectomy. We also investigated the relationship of various commonly described ultrasonographic findings to histologically proven acute cholecystitis.

2. Methods

Prospectively collected data of patients presenting to the Emergency Department with acute upper abdominal pain from January 2010 through October 2012 was retrospectively reviewed. If patients had undergone AUS and/or HIDA scan and cholecystectomy within 5 d of the initial presentation, they were included in the analysis. This study was performed by the Department of Surgery at St. Joseph Mercy Hospital, Ann Arbor, MI, and approved by the Institutional Review Board. Clinicopathologic data included patient demographics, AUS findings, HIDA scan results, intraoperative findings, and histopathologic results. Patients were excluded if they had no available imaging, did not undergo cholecystectomy, or had gallstone pancreatitis. In addition, pregnant women, prisoners, and patients under 18 y were excluded, as well as cases in which there were technical difficulties in obtaining adequate views of the gallbladder on AUS, longer than 5 d interval between initial presentation and surgery, and the presence of pathology such as ascites, severe right sided heart failure, hypoproteinemia, or multiple myeloma that would make ultrasound assessment difficult and/or inaccurate.

2.1. *Diagnosis of acute cholecystitis*

Patients were considered to have acute cholecystitis on AUS, if a diagnosis of “acute cholecystitis” or “likely or equivocal acute cholecystitis” was given by a board-certified, attending radiologist based on the constellation of the AUS findings. Several AUS finding were taken into account including the presence of sonographic Murphy sign, gallbladder wall thickening >5 mm, presence of pericholecystic fluid, and presence of hydrops with increased transverse gallbladder diameter. Presence and location of stone(s) or sludge were also taken into consideration. Radiology reports where any of these findings were listed as not present or were not noted were considered to be negative for the finding.

An HIDA scan was considered positive if the imaging study, as assessed by an attending radiologist, was read as acute cholecystitis or if the gallbladder was not visualized (i.e., persistent cystic duct obstruction through the imaging sequence was noted) and partial or complete common bile duct obstruction was not suggested. In our institution, Technetium-99m mebrofenin is used as our tracer in a dose of 5 mCi. The patient is fasted for at least 2 h before the test. If the patients have been fasting for more than 24 h, they are pretreated with a short (3 min) cholecystokinin infusion 30 min before injecting the tracer. If the gallbladder was not visualized at 60 min despite common bile duct and/or gut visualization, morphine was injected intravenously at a dose of 0.04 mg/kg of body weight to close the sphincter of Oddi and raise common bile duct pressure. If the gallbladder was visualized within 30 min of the morphine injection, a diagnosis of chronic cholecystitis was made. If the gallbladder was not visualized within 30 min after the morphine injection, a diagnosis of acute cholecystitis was made. If the patient was allergic or could not tolerate intravenous morphine, a delayed image was taken at 3 h after the tracer injection with the same dichotomous interpretation. If there was liver visualization, but no biliary tract or gut visualization at 60 min after the tracer injection, the test was aborted, and the patient was given the diagnosis of acute common bile duct obstruction or marked hepatocellular disease depending on the degree of tracer clearance from the cardiac blood pool and ancillary laboratory information.

The histopathologic findings obtained included the presence and number of stones, gallbladder wall thickness in millimeters, gallbladder structure (e.g., necrosis, gangrene, and hemorrhage) after dehydration with formaldehyde, and the overall diagnosis of cholecystitis based on transmural leukocyte infiltrates. Histologically positive acute cholecystitis was determined by the pathologist’s interpretation as acute