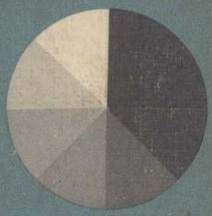
CLINICS IN DIAGNOSTIC ULTRASOUND 14



Coordinated Diagnostic Imaging

Edited by

Joseph Simeone

CHURCHILL LIVINGSTONE

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Foreword

Those of us who started relatively early in the development of modern diagnostic radiology remember the days when the only thing that we had was direct radiography of the body parts, fluoroscopic examination of the gastrointestinal tract and of the heart, pneumoencephalography, and ventriculography for the brain. Cerebral angiography and other types of angiography were in their infancy in the middle of the decade of the 1940s. In 34 years since 1950 we have seen profound developments in diagnostic imaging. Initially, both ultrasound and radionuclide diagnostic approaches did not really include imaging. Imaging possibilities with both of these modalities developed in the 1960s, although attempts to obtain cross-sectional images with ultrasound were made between 1950 and 1960. The concept of cross-sectional imaging received a tremendous boost with the introduction of computed tomography in 1972 and will undoubtedly receive additional attention as magnetic resonance imaging becomes clinically applicable.

The concept of cross-sectional imaging in all possible planes represents one of the greatest single advances in diagnostic medicine in the last 50 years. Cross-sectional diagnostic imaging requires a thorough knowledge of gross anatomy and I can see the radiologist now as rivaling the surgeon in the detailed knowledge of in vivo anatomy, which can be presented in all manners of projections and planes, distorted by the pathologic processes.

Ultrasound has been unrivaled in its ability to yield anatomic cross-sectional images in any desired plane, and in this ultrasound is far superior to x-ray computed tomography. However, with the advent of magnetic resonance I can see ultrasound losing some of its advantage, because the magnetic resonance images are significantly clearer and easier to interpret from the point of view of anatomy. The advantages of ultrasound will remain its ease of application and the fact that the instrumentation is so much less expensive.

As we look at the future, what we will be faced with is an array of imaging approaches including radionuclide two-dimensional and cross-sectional imaging, ultrasound, computed tomography, and magnetic resonance. In addition, we will have the usual radiographic and x-ray tomography and other techniques such as angiography. As time goes on we find an ever increasing need to coordinate all of these imaging approaches in the best possible manner in order to provide an optimum consultative service to the patient. This volume on coordinated diagnostic imaging should be very useful in this respect.

Juan M. Taveras, M.D.

Foreword

In the brief 15-year history of ultrasonography as a major diagnostic technique, a remarkable succession of advances in instrumentation has opened new areas of clinical utility on an almost yearly basis. Until recently, the main thrust of clinical investigation has been documentation of pathoanatomic correlations and determination of sensitivity and specificity of ultrasound patterns in various disease states.

With the gradual maturation of sonography and its widespread clinical acceptance, comparison with other imaging modalities and integration into the diagnostic armamentarium have become the order of the day. In this volume, Guest Editor Joseph F. Simeone, M.D., has selected important clinical topics where the impact of ultrasound has been substantial, although perhaps not exclusive. In stressing coordinated imaging, he and the expert contributing authors present an up-to-date, authoritative, real-world analysis of the relative role of sonography including its strengths and weaknesses vis-à-vis complementary and/or competing modalities for diagnosis.

Successful radiologist-imagers generally provide their most critical referring clinicans with a combination of relevance, competence, enthusiasm, and last but not least, objectivity. The distinguished sonographers writing herein have discharged that obligation admirably.

Joseph T. Ferrucci, Jr., M.D.

Preface

If a radiologist were to participate in a word association test, the following responses might be elicited to these provocative terms: Diagnostic algorithm: boring, tedious, rarely useful; DRGs: mysterious, frightening, threatening.

While the word *algorithm* brings to the mind of the radiologist a diagram with a myriad of interconnecting, undecipherable lines, which unnecessarily complicate the work-up of a clinical problem and while DRGs (Diagnostic Related Groups) represent the most recent attempt at regulation and imposition of outside controls on the radiologist's practice, both are interrelated and of increasing importance in the practice of radiology in the 1980s. DRGs will force the radiologist and clinician to perform the most cost-efficient, inexpensive, efficacious work-up of a patient with a specific clinical problem. While every radiologist carries in his mind *his* best series of diagnostic tests to work up a particular clinical problem in his hospital or practice, the actual enunciation and elucidation of this personal working algorithm is not generally written down or well publicized.

The general purpose of this book is to provide the most up-to-date information on the work-up of various clinical problems by a group of nationally known radiologists with proven expertise in their area. The specific purpose of the book is to define where diagnostic ultrasound fits into the work-up of these problems when other imaging modalities are also available. For example, in Chapter 1, Dr. Ralls and colleagues gives his opinion as to the best way to work up patients with right upper quadrant pain and specifically a question of acute cholecystitis. He squarely addresses the controversy as to whether a scintigraphic scan or an ultrasound scan should be done first. He favors ultrasound as the first choice and uses it in his daily clinical practice. Other chapters within the book are constructed in the same way. If ultrasound does not give adequate information on a particular topic, the authors will state that. Dr. Kopans, in his chapter on breast imaging, clearly indicates that ultrasound is not to be used as a screening procedure. In the chapters on abscess detection and pelvic mass detection, the role of ultrasound and its limitations are clearly outlined and the areas where CT is preferred are emphasized.

It seems that in the future radiologists will not have the luxury of working up a particular clinical problem with a flurry of diagnostic examinations. The quickest, easiest imaging examination giving the best diagnostic information and requiring the least expense and fewest days of hospitalization will be required by health care regulations and cost control groups. The authors of

the various chapters of this book have done an excellent job in trying to put into perspective the various diagnostic modalities available for common clinical problems and how to use them.

Joseph F. Simeone, M.D.

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CASE STUDIES

1 Right Upper Quadrant Pain

PHILIP W. RALLS
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Historically, assessment of acute right upper quadrant abdominal pain has been a considerable clinical challenge. While clinical findings and laboratory data frequently narrow the differential diagnosis, symptom overlap generally precludes definitive diagnosis among the various diseases causing acute right upper quadrant pain. Fortunately, the advent of newer diagnostic imaging modalities has greatly improved the rapidity and reliability of diagnosis in these patients.

An additional challenge to the physician, with increased awareness of the importance of cost effectiveness in medicine, is to select appropriate diagnostic schema that rapidly establish accurate diagnoses in the most economical fashion possible. The dual goals of this discussion are to assess not only the accuracy of techniques used to evaluate patients with acute right upper quadrant pain, but also to seek out cost-effective, coordinated imaging techniques to achieve this goal.

Acute right upper quadrant abdominal pain has many causes, not all of which are intraabdominal in origin (Table 1.1). Acute cholecystitis, almost always caused by calculous obstruction of the cystic duct,[1] is the most frequent cause of right upper quadrant pain, requiring urgent management (Table 1.2). Consequently, it is crucial for the surgeon, with the aid of the diagnostic imager, to establish the presence or absence of acute cholecystitis both rapidly and with a high degree of reliability. Once acute cholecystitis has been excluded, other diseases may be sought. Since determining the presence or absence of acute cholecystitis is so important, the capability of imaging examinations to assess acute cholecystitis accurately has become the watershed for determining the test of choice in evaluating patients with acute right upper quadrant pain.

TABLE 1.1. Common causes of right upper quadrant pain

Thoracic
Pneumonia
Pulmonary embolism
Coronary artery disease
Congestive heart failure with hepatic congestion
Abdominal
Acute cholecystitis
Chronic cholecystitis
Cholangitis
Hepatitis
Liver abscess
Duodenal ulcer
Pancreatitis
Right pyelonephritis
Acute appendicitis
Gonococcal perihepatitis
Inflammatory bowel disease
GI malignancy
Miscellaneous
Degenerative disease of the spine
Retroperitoneal malignancy

ACUTE CHOLECYSTITIS

Calculous Cholecystitis

Acute cholecystitis consists of a pathologic triad of obstruction of the cystic duct, inflammation, and ischemia. While inflammation or ischemia may occa-

TABLE 1.2. Common causes of acute right upper quadrant pain requiring urgent or emergent therapy

Myocardial infarction
Acute cholecystitis
Perforated duodenal ulcer
Suppurative cholangitis
Acute appendicitis
Hepatic abscess

sionally cause acute cholecystitis primarily, the preponderant majority of cases of acute cholecystitis are due to calculous obstruction of the cystic duct,[2] which causes well over 90% of acute cholecystitis.[3]

The clinical presentation of acute cholecystitis generally consists of acute onset of right upper quadrant pain, usually associated with fever, anorexia, and nausea and vomiting. The clinical Murphy sign (not to be confused with the sonographic Murphy sign), is frequently present. The clinical Murphy sign consists of pain and inspiratory arrest during deep inspiration while the examining physician palpates the right subcostal region. A palpable gallbladder is present in approximately one-third of patients with acute cholecystitis. Typically, the leukocyte count is in the range of 12,000–15,000. Mildly elevated alkaline phosphatase, bilirubin, and amylase levels may be present without any detectable biliary obstruction or inflammation of the pancreas or liver.[3] Studies have shown that experienced physicians can make the correct diagnosis of acute cholecystitis in slightly more than 60% of patients at the time of initial evaluation.[4]

Acalculous Cholecystitis

Acalculous cholecystitis has been reported to represent 2–10% of patients with acute cholecystitis.[5] Its true incidence is difficult to assess, since some cases almost certainly represent patients who had calculous cholecystitis and subsequently passed the stones.[6, 7] It may be caused by vascular compromise, vagal abnormalities, trauma, pancreatitis, and cystic duct obstruction (torsion, stricture, or neoplasm).[5] Since acalculous cholecystitis frequently occurs in the elderly and in patients with other serious illnesses, clinical diagnosis may be difficult.

MANAGEMENT OF ACUTE CHOLECYSTITIS

Historically, patients with acute cholecystitis have been treated conservatively during the acute phase, undergoing elective cholecystectomy after the disease process has "cooled off."[8] Over the past few decades, the surgical approach to acute cholecystitis has been changing.[9] Controlled prospective clinical trials have shown that management of patients with acute cholecystitis by urgent cholecystectomy (within the first 24–48 hours after clinical presentation) is an effective means of decreasing morbidity and mortality and of shortening hospital stay.[10, 11]

Not all surgeons advocate early cholecystectomy for acute cholecystitis.[1] Some believe that surgery during the acute phase of cholecystitis is more difficult. Another objection is that management by urgent cholecystectomy does not permit enough time to preclude misdiagnosis, perhaps leading to unneeded or even contraindicated surgery.[1, 8] This attitude emphasizes the need to assess acute right upper quadrant pain both rapidly and accurately.

IMAGING IN ACUTE CHOLECYSTITIS

It must be remembered, when assessing imaging techniques in acute cholecystitis, that one is evaluating a highly selected patient population. Diagnostic imagers are dependent on the referring primary clinician to choose appropriate patients. The high accuracy rates feasible with modern diagnostic imaging techniques are due, in part, to this clinical preselection.

Many tests have been used to evaluate patients with acute cholecystitis (Table 1.3). Oral cholecystography is capable of very high accuracy (well over 90%)[12] in detecting gallbladder disease. Unfortunately, this method is unsuitable for assessing acute cholecystitis. Nausea and vomiting preclude oral cholecystography in many patients with acute cholecystitis. Oral cholecystography may require 48 hours, unacceptably long when early cholecystectomy is used to manage acute cholecystitis. Although oral cholecystography detects gallbladder disease accurately, it is not specific for acute cholecystitis. Finally, patients with quiescent gallbladder disease may have other, unrelated causes of acute pain.

Infusion tomography of the gallbladder has been used to evaluate patients with acute cholecystitis.[13] With this technique, gallbladder tomograms are obtained while intravenous contrast is infused. Demonstration of increased gallbladder wall thickness has been proposed as diagnostic of acute cholecystitis. Controlled clinical trials have shown that this technique is unreliable, and thus should be discarded.[14]

For many years, intravenous cholangiography was the standard technique used to assess patients with suspected acute cholecystitis.[15] Nonvisualization of the gallbladder when adequate bile duct opacification occurs implies cystic duct obstruction and acute cholecystitis (Fig. 1.1). The ability of intravenous cholangiography to assess the presence or absence of cystic duct obstruction has great appeal, since it is the usual cause of acute cholecystitis. Opacification of the gallbladder means the cystic duct is unobstructed, ruling out acute cholecystitis.

Unfortunately, difficulties arise when intravenous cholangiography is used to evaluate patients with suspected acute cholecystitis. Although biliary ductal opacification occurs in more than 90% of normals,[16] this high rate of adequate examinations cannot be obtained in patients who actually have acute cholecystitis. Adequate opacification of bile ducts occurs in only 47 to 62% of patients

TABLE 1.3. Imaging examinations used to evaluate acute cholecystitis

Oral cholecystography
Intravenous cholangiography
Infusion tomography of the gallbladder
Real-time sonography
^{99m}Tc-IDA analogue cholescintigraphy