Role of multidetector computed tomography (MDCT) in diagnosis of subhepatic appendicitis

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Abstract  Background: Acute appendicitis is a common surgical condition that is usually managed with early surgery, and is associated with low morbidity and mortality. However, some patients may have atypical symptoms and physical findings that may lead to a delay in diagnosis and increased complications.

Ascending subhepatic appendicitis presenting with right upper abdominal pain may be clinically indistinguishable from acute pathology in the gallbladder, liver, biliary tree, right kidney and right urinary tract.

Aim of the work: To study the role of multidetector computed tomography in diagnosis of subhepatic appendicitis.

Subjects & methods: In the current study, we included fifteen patients diagnosed radiologically and confirmed surgically as subhepatic appendicitis.

Ultrasound followed by multidetector computed tomographic examination were performed to all patients before surgery.

Results: The clinical diagnosis of the patients included in this study at presentation was acute cholecystitis in four patients, pyelonephritis in three, and ureteric colic in three. Five patients were referred with uncertain diagnosis.

The presence of subhepatic appendicitis was confirmed sonographically only in two patients. Computed tomography (CT) identified correctly subhepatic appendicitis in all cases.
1. Introduction

Several locations of the vermiform appendix occur in relation to the cecum. The most common positions are descending intraperitoneal (31–74%) and retrocecal (26–65%) locations (1,2).

The spread of inflammation and hence the clinical presentation from acute appendicitis depends on the location of the appendix. If the appendix is located subhepatically, it may give rise to an abscess in the subhepatic space and spread to the tail of the liver [3], or it may spread along the right paracolic gutter, and extend to the right subphrenic spaces [4].

Most of the patients with ascending subhepatic appendicitis may have an atypical clinical presentation [5].

We present 15 cases of subhepatic appendicitis with atypical clinical presentation, and highlight the utility of multi-detector computed tomography (MDCT) and its software post processing applications in diagnosing the condition.

2. Materials and methods

This study included fifteen patients presented to the radiology department in Alexandria University, during the period from January 2011 till December 2011 with clinical presentation of acute right upper abdominal pain and were diagnosed radiologically by multidetector computed tomography as subhepatic appendicitis and the diagnosis was confirmed by surgery.

Clinical features, laboratory investigations and surgical findings were included in the study.

Ultrasonography followed by multidetector computed tomographic examination were performed to all patients. Computed tomographic examination was performed from the level of the dome of the diaphragm through the pubic symphysis using a 16-slice-CT scanner (Toshiba – Activion scanner). The protocol was as follows: 140 kVp; 350 mA; sections, 16; section thickness, 0.625 mm; pitch, 1.75; table speed, 35 mm/s (17.5 mm per rotation with two rotations); and gantry speed 0.5 s per rotation.

In 10 patients, Iopamidol (Isovue; Bracco Diagnostics, Princeton, NJ) was injected (Empower CT; E-Z-Em) at a dose of 150 mL (300 mg of iodine per milliliter) and a rate of 3 mL/s. Scanning was performed during the portal venous phase as determined with bolus tracking and automated triggering technology. Five patients have undergone emergency plain CT examination without intravenous contrast injection.

The transverse section data were reconstructed with 0.625-mm-thick sections at 0.625-mm intervals. The data were sent to the workstation and coronal, sagittal and curved multiplanar reformatted images were then obtained.

3. Results

Among the fifteen patients included in this study there were eight females and seven males. Their ages ranged from 14 to 44 years old (average 27 years). All the patients presented with upper right acute abdominal pain. The clinical diagnosis at presentation was acute cholecystitis in four patients, pyelonephritis in three, and ureteric colic in three. Five patients were referred with uncertain diagnosis. Elevated leukocytic count was detected in twelve patients.

Ultrasonography was performed to all patients and showed unremarkable findings in seven patients, mild subhepatic fluid collection in four patients and considerable amount of paracolic and subhepatic collections in four patients. The presence of subhepatic appendicitis was confirmed sonographically only in two patients.

Multidetector computed tomography was then performed and adequately diagnosed subhepatic appendicitis in all patients. The subhepatic location of the appendix was confirmed by reviewal of the axial images as well as the coronal, sagittal and curved multiplanar reformatted images.

Ten of the patients had CT signs of non complicated appendicitis including dilated thick walled appendix and thickening and stranding of the adjacent fascial planes with mild free fluid formation in the subhepatic space and right paracolic gutter. Five patients had additional CT signs of complicated appendicitis including considerable fluid collections in the right paracolic gutter and subhepatic spaces in four patients out of which two patients had a considerable amount of free intraperitoneal fluid. One patient had marked stranding in the adjacent right paracolic gutter with the appendix seen amalgamated with the adjacent small bowel loops raising the possibility of phlegmon formation. A calcified appendicolith was detected in four patients.

Surgical exploration was done to all the patients following the computed tomographic examination. The appendix was detected in a subhepatic location in all patients. Ten patients had non complicated appendicitis, four patients had perforated appendix and one patient had an appendicular phlegmon with partial perforation of the appendix. Appendectomy was performed to all patients. The surgical findings were matching with the CT findings in all the patients.

Figs. 1–5 show demonstration of the CT findings in five patients included in this study.

4. Discussion

Typical form of ordinary acute appendicitis may be diagnosed easily and treated in children and adults if there is a classical history with typical clinical signs [5]. On the other hand, atypical location of the appendix would present with clinical and radiodiagnostic dilemma. When the appendix is in the ascending subhepatic position, the signs and symptoms of acute appendicitis may be atypical and may be misdiagnosed with other pathology in the right flank and hypochondrium, such as acute cholecystitis, diverticulitis, acute gastroenteritis, ureteric colic, acute pyelonephritis, colon cancer and irritable bowel syndrome [6]. This is matching with our study as the clinical diagnosis at presentation was acute cholecystitis in four patients.
patients, pyelonephritis in three, and ureteric colic in three and five patients were referred with uncertain diagnosis.

Ultrasound is the primary screening modality of choice when the clinical impression of gallbladder, hepatobiliary or urinary tract pathology is considered. Although ultrasound is used frequently in the assessment of suspected acute appendicitis in young children and sometimes in adults, it requires expertise, and dedicated techniques using graded compression to expose the appendix and displace surrounding bowel loops [7].

After the era of MDCT and its software applications, notably the multiplanar reconstruction, curved planar reconstruction for tortuous structures, adjoining with inherited advantages such as fast technique, which in turn is helpful in an emergency patient in agony, and ability for thin slice reconstructions as well as small and large bowel enterocolonography techniques added much to the diagnosis of appendicitis. In adults, un-enhanced CT has been shown to be more sensitive in diagnosing acute appendicitis than ultrasound [8].

In our series of 15 patients, acute appendicitis was not suspected in any of them and most of them were referred as right hypochondrial pain of hepatobiliary or renal origin, therefore, the ultrasound scan performed was not dedicated to rule out appendicitis. This explains the reason for failure of ultrasonog-
raphy to confirm the diagnosis of subhepatic appendicitis in most of the patients included in this study.

Paulson et al. [9] concluded in a study performed on one hundred patients using a 16 section multidetector CT scanner that reformatted images especially coronal ones improve con-

Fig. 3 A 40-year old female presenting with acute upper abdominal pain mainly in the right side. Multislice CT images of the abdomen: Axial (A), coronal (B), sagittal (C) and curved multiplanar (D) images showing dilated thick walled appendix with its tip extending to the subhepatic region (small arrows in (A) and large arrow in B, C & D) with a calcified appendicolith seen in its base (small arrow in (C)). Considerable subhepatic collection is seen in (D) with signs of perforation of the tip of the appendix. Diagnosis of perforated subhepatic appendicitis was confirmed surgically.

Fig. 4 A 14-year old female presenting with right upper abdominal pain clinically diagnosed as acute pyelonephritis. Multislice CT images of the abdomen: Axial (A & B) and sagittal (c) and coronal (D) images showing dilated appendix with thickened enhancing wall. The appendix is seen extending from the cecum to the subhepatic region adherent to the adjacent bowel loops (large arrow in A, B & D) with stranding of the adjacent fat and showing a small appendicolith. Free extraluminal air foci are also seen (arrow in (C)) features suggesting complicated subhepatic appendicitis with perforation and phlegmon formation. These findings were all confirmed surgically.
fidence of visualization of the appendix. The main key for diagnosis of ascending retrocecal subhepatic appendicitis using multidetector computed tomography in this study was adequate delineation of the position of the appendix and confirming the subhepatic location of its tip. In addition to review of the axial sections, reformatted coronal, sagittal and curved multiplanar images were useful in confirmation of the subhepatic location of the appendix in the patients included in our study.

MDCT is very sensitive for evaluating the normal and thickened wall appendix, inflamed peri-appendiceal fat, collections, and presence of free gas in ruptured appendix. The inflammatory changes that result from an acutely inflamed ascending retrocecal appendix may extend to the perirenal, adrenal and subhepatic regions, and on rare occasions, inferior extension along the psoas muscle into the thigh has been reported [10,11].

All these findings are matching with the CT findings detected in our study, ten patients had CT signs of non complicated appendicitis and five patients had additional CT findings of complicated appendicitis including considerable amount of fluid collections in the right paracolic gutter and subhepatic spaces in four patients out of which two patients had considerable amount of free intraperitoneal fluid. One patient had marked stranding in the adjacent right paracolic gutter with the appendix seen amalgamating with the adjacent small bowel loops raising the possibility of phlegmon formation. The surgical findings were matching with the CT findings in all patients.

Our case series illustrated a spectrum of uncommon clinical and radiological manifestations of ascending subhepatic appendicitis. This emphasizes the importance of considering the possibility of ascending subhepatic appendicitis in cases in which the signs and symptoms are referred to areas along the possible location of a subhepatic appendix, especially when initial investigations like ultrasound do not support other diagnoses, such as cholecystitis, or hepato-biliary or urinary tract pathology. We agree with Eugene et al. [12] who emphasized the importance of multidetector CT in diagnosis of subhepatic appendicitis in a study performed on four patients presenting with right upper abdominal pain.

Finally we conclude that multidetector CT is useful for evaluation of patients with atypical right upper abdominal pain and nonspecific clinical findings, to rule out the possibility of subhepatic appendicitis, still the examination has to be reviewed by an experienced radiologist who is oriented with such clinical entity and capable of utilizing the advantage of multiplanar reformatted images in detection of the subhepatic position of the appendix and evaluation of the extent of the associated inflammatory process.

Fig. 5 A 20-year old female presenting with right upper abdominal pain. Multislice CT images of the abdomen: Axial (A, B & C) showing thickening and stranding of fat in the retrocecal region (arrow in (A)) with encysted thick walled collection seen in the right paracolic gutter (arrow in (B)) as well as retroperitoneal collection and air foci seen in the right posterior pararenal space (arrow in (C)). Coronal image (D) adequately traced the appendix (arrow) showing thickened enhancing wall. Diagnosis of complicated perforated subhepatic appendicitis was confirmed surgically.

References


