

## *Original Paper*

# Clinical Application and Value of Ultrasound in Diagnosis of Acute Abdomen—A Single Center Experience

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### **Abstract**

*This study is an analysis of the clinical value of ultrasonic diagnostic technique in the differential diagnosis of acute abdomen of the liver and gallbladder. Methods from January 2015 to November 2017, 641 cases of acute abdomen admitted to Macao Conde de Sao Januario Hospital were retrospectively analyzed. Among 641 cases of acute abdomen, 280 cases (43.7%) were diagnosed as acute appendicitis, 168 cases (26.3%) had acute pancreatitis, 79 cases (12.3%) had acute cholecystitis, 65 cases (10.1%) had urinary stones, 49 cases (7.6%) had liver abscesses. In 641 cases of acute abdominal disease, 584 cases were consistent with the results of ultrasonic examination and final diagnosis, which accounted for 91.1% of the total number of cases. Therefore, ultrasound diagnostic technology has a good clinical value in identifying acute abdomen, which helps to make correct pathological diagnosis, reduce misdiagnosis rate, and has no radiation and noninvasive. Therefore, it is worth further use in clinical application.*

### **Keywords**

*acute abdomen, ultrasound diagnosis, clinical application*

## **1. Introduction**

Acute abdomen is caused by rapid pathological changes of peritoneum, abdominal cavity and pelvic organs and organs, resulting in acute appendicitis, acute intestinal obstruction and other diseases. The causes usually include inflammatory infection, abdominal bleeding, vascular disease and so on. The patient with acute abdomen has a rapid and varied condition (Paduszynska, Celnik, & Pomorski, 2012). It is of great significance to improve the diagnosis of acute abdomen in the treatment of acute abdomen. In this study, ultrasonic diagnosis of patients with acute abdomen has achieved good clinical results, and the results are reported as follows.

## 2. Materials and Methods

*Patients:* This study is presented to the emergency department of our hospital from January 2015 to November 2017 and the ultrasound diagnosis of 641 patients with acute abdomen were retrospectively analyzed. The average age is 61.45 years (age 7-92). 453 cases were confirmed by surgery and pathology, and the other cases were confirmed by puncture, test or other clinical data. The number of male patients is 308, the number of female patients is 333, the onset time of all patients is  $28 \pm 2.5$  hours. All patients had abdominal pain, nausea, vomiting, abdominal distension, etc.

*Technique:* After admission, the patients were initially diagnosed according to the patients' complaints and clinical symptoms, and then the patients were examined by emergency ultrasound. If the patient's clinical symptoms are mild, the patient is fully drinking water, ensuring the filling state of the bladder. If the clinical manifestations of the patients with severe symptoms, with intravenous rehydration the bladder can meet the emergency ultrasonography. The patient needs different body position coordination during abdominal scan, including supine position, lateral position, and bladder stone position. The location and suspicious location of pain will be scanned with emphasis, so as to understand the location, scope, shape and nature of the lesion.

*Abdominal US:* All abdominal ultrasound examinations were conducted by a qualified radiologist in our hospital. The machine we used for examination is GE LOGIQ E9 (GE Healthcare corporation, USA) with C1-5 curved probe (GE Healthcare corporation).

*Diagnostic criteria of diseases:* Ultrasound finding of acute cholecystitis was diagnosed by (1) gallbladder enlargement, short diameter enlargement and contour blurring; (2) thickening and edema of gallbladder wall; (3) gallbladder tenderness, namely sonographic "Murphy sign"; fourth, common calculus or floc deposition in gallbladder cavity; (4) hypoechoic or anechoic band around gallbladder (Yokoe et al., 2012).

The clinical manifestations of acute pancreatitis are usually upper abdominal pain, and serum amylase is elevated. The ultrasound examination revealed the swelling of the pancreas and the presence of hypoechoic regions around the pancreas (Wu & Banks, 2013).

The main manifestations of acute appendicitis are right lower abdominal pain, ultrasound imaging can show the enlargement of appendix, diameter > 10mm, wall thickening, and peristalsis disappear (Ooms, Koumans, Ho Kang You, & Puylaert, 1991; Rodgers & Verma, 2013).

The clinical manifestations of liver abscess are fever and right upper abdominal pain, the laboratory examination of leukocyte increase and CRP increase. The ultrasonographic manifestations were mainly hypoechoic (irregular internal echoes). Bubbles may also be seen. Color Doppler will show no central perfusion (B ähler et al., 2016).

Ultrasound finding of nephrolithiasis showed echo ultrasonic focusing, acoustic shadow, color Doppler twinkling artifacts, color comet tail artifact (Tchelepi & Ralls, 2009).

### 3. Result

Of the 641 patients, the coincidence rate of ultrasound diagnosis and final diagnosis was 94.6%, as shown in Table 1.

**Table 1. Comparison of Coincidence Rate between Emergency Ultrasound Diagnosis and Final Diagnosis [n (%)]**

Disease category	No of case	Diagnosis of ultrasound	No. of misdiagnosis	Coincidence rate (%)
Acute appendicitis	280(43.7)	265(45.4)	15(26.3)	94.6
Acute cholecystitis	79(12.3)	75(12.8)	4(7.0)	94.9
Liver abscess	49(7.6)	46(7.8)	3(5.3)	93.8
Nephrolithiasis	65(10.1)	63(10.8)	2(3.5)	96.9
Acute pancreatitis	168(26.3)	135(23.2)	33(57.9)	80.4
Total	641	584	57	91.1

From Table 1, 641 cases of acute abdomen in this study, ultrasonic diagnosis coincidence rate reached 91.1%. The diagnostic accuracy of ultrasonography was 94.6%, 94.9%, 93.8%, 96.9% and 80.4% in confirmed cases of acute appendicitis, acute cholecystitis, liver abscess, nephrolithiasis and acute pancreatitis.

### 4. Discussion

Acute abdomen is a common disease with many causes, which is characterized by acute disease, rapid change and severe illness. It is necessary to make the diagnosis in time and take the corresponding treatment measures. The ultrasound can make the diagnosis of the cause quickly and the accuracy is high. Therefore, the key to rapid diagnosis is to master the characteristics of the sound image of these diseases. In this study, there were 280 cases of acute appendicitis, with a total of 43.7%. The second was acute pancreatitis in 168 cases, accounting for 26.3%. Acute cholecystitis, urinary system and liver abscess were 79 cases, 65 cases and 49 cases respectively. 12.3%, 10.1% and 7.6% respectively. The coincidence rate of clear diagnosis and final diagnosis in all cases was 91.1% (584/641). Therefore, ultrasound examination is of great value in the clinical diagnosis of acute abdomen.

Ultrasound is ultrasonic morphologic examination, ultrasonic wave through the interface and the human body each organ structure, produce reflection echo with different degree. At the same time, the spot light is directly displayed on the instrument on the spot, the composition of image plane, which can clearly show the lesion of the shape, size, location and organ structure, etc. In addition, the operator produces pain when the operator uses ultrasound to pressurize the patient to determine the presence of the urinary system, gallstones, the thickness of the gallbladder wall, or the expansion of the gallbladder, accurate measurement of the diameter of the cystic duct, and by the presence of gas

downstream from the diaphragm to the diagnosis of digestive tract perforation, obstruction, tumor, etc. Moreover, we can exclude pancreatitis more accurately, identify the size and location of the mass, and the relationship with its associated tissues, and determine the location, reason and degree of the obstructive lesions in the body. Therefore, the probability of using the strip examination is reduced and the damage to the patient's body is avoided by the ray. For pregnant women and children, ultrasound examination has no damage to the human body, reducing the injury to pregnant women and children, and ensuring the health of pregnant women and children.

In the case of misdiagnosis, we summarize the reason and analysis.

One of the main causes of misdiagnosis is intestinal gas. Gas at the site of the disease makes it difficult to perform the examination (Hoffmann, Nurnberg, & Westergaard, 2012).

When the appendix is not in the normal position, it cannot be clearly displayed. It is difficult to diagnose acute appendicitis with abdominal ultrasound (Estey, Poonai, & Lim, 2013). Among 15 miss-diagnostic cases of acute appendicitis, 10 cases were not in the normal anatomical position, 3 cases were in the pelvic cavity, 5 cases were in the posterior part of the cecum, and 2 cases were located in the lateral part of the cecum. Because the position of duodenum and gallbladder is very close, the pain caused by duodenal ulcer sometimes causes sonographic Murphy sign, which is misdiagnosed as acute cholecystitis (Myrianthefs, Evodia, Vlachou, Petrocheilou, Gavala, Pappa, & Karakitsos, 2012; Tomizawa et al., 2017). We have a case of misdiagnosed duodenal ulcer which is misdiagnosed as acute cholecystitis.

In this study, the diagnostic accuracy of acute pancreatitis is relatively low. Although CT is better than ultrasound in the diagnosis of acute pancreas, ultrasound has a certain diagnosis in emergency pancreatitis. Ultrasound can be found that the stones that cause obstruction of the biliary tract are hyperechoic because of the stones. After analysis, limited by a variety of factors, including the following aspects: 1) acute pancreatitis can lead to intestinal paralysis, resulting in abdominal gas buildup inside and affect the image of the pancreas; 2) of obese patients with pancreatitis, pancreatic part structure is difficult to clearly show that ultimately affect the results of ultrasonic diagnosis; 3) ultrasound physicians the lack of relevant experience and operational errors (Mergener & Baillie, 1998; Banks et al., 2012).

Liver abscess is a localized purulent lesion caused by amoeba protozoa or bacterial infection. It is mainly distributed in the right lobe of the liver. It may be related to the special anatomical structure of the portal system. The main symptoms and characteristics of liver abscess are chills, fever, abdominal pain and hepatomegaly. There are many different manifestations of the abscess's image, and its evolution is related to the course of the disease and the degree of liquefaction of the abscess. Especially in the early stage and incomplete liquefaction stage, the abscess area is distributed with uneven middle to low echo. There is no clear wall and blurred and irregular border with the surrounding liver tissue, which is very similar to hepatic malignancy. This is the cause of misdiagnosis (Burns & Wilson, 2007; Claudon, Dietrich, Choi, Cosgrove, Kudo, Nolsøe, & Xu, 2013).

Urinary calculi are also one of the causes of acute abdomen. The clinical manifestations were abdominal pain, hematuria, dysuria. Stones with a general diameter of less than 3 millimeters are difficult to find under ultrasonic examination. In the cases of our missed diagnosis, it is difficult to diagnose the echo of the stone when the patient is accompanied by chronic kidney disease or kidney atrophy (Varma et al., 2009).

Due to the presence of intestinal gas, bile duct cancer and sigmoid colonic torsion are more difficult to be diagnosed by abdominal ultrasound.

The limitations of this study are a retrospective study, not a random study. And this time only the ultrasound examination cannot be compared with other imaging methods, so there may be errors. In addition, this study is a single center study, so it cannot be compared with other places. The primary purpose of this study was to assess the diagnostic performance of abdominal ultrasound in patients with abdominal symptoms. If there is information from other diagnostic imaging examinations before abdominal ultrasonography, the information may affect the overall outcome of the abdominal ultrasound.

In conclusion, the ultrasonic examination is simple, fast, noninvasive, repeatable and so on. In the diagnosis of acute abdomen, ultrasonography can directly display the location and scope of the lesion, and the effusion around the viscera and abdominal cavity. At the same time, it can accurately determine the type and degree of the disease, and provide a reliable diagnostic basis for clinical operation. At the same time, for patients with conservative treatment, ultrasound follow-up examination helps to understand the progress of the disease and estimate the prognosis, so it can be used as the preferred auxiliary examination method for the diagnosis of acute abdomen in hospitals.

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