

Role of Ultrasound in Acute Non Traumatic Abdominal Emergencies

Kamlesh Gupta, Ramesh Chander, Arvinder Singh, Sohan Singh, Sandeep Singh

Abstract

The current study was undertaken to assess the role of ultrasound in acute non traumatic abdominal emergencies, analysis of ultrasound findings and its correlation with clinical findings, laboratory and other radiological investigations along with operative findings, wherever possible and to determine the sensitivity and specificity in diagnosing various conditions. A total of 100 patients included in this study underwent abdominal ultrasonography. Definite diagnosis was made in 87 cases (87%). The sensitivity and specificity of ultrasound in diagnosing acute appendicitis, perforation of a hollow viscus, intestinal obstruction and acute pancreatitis was around 86.1% and 83.3%, 86.3% and 80%, 93.7% and 80%, 70% and 75% respectively. In biliary conditions, ultrasound examination was highly sensitive. In diagnosing Hepatobiliary conditions ultrasonography is highly sensitive and highly specific. In diagnosing other conditions such as acute appendicitis, perforation, intestinal obstruction, acute pancreatitis and ureteric colic, ultrasonography have good overall sensitivity and specificity. Ultrasonography should be a part of routine surgical investigations as it guides in timely intervention in surgical cases.

Key Words

Acute Abdomen, Non Traumatic, Abdominal Emergencies, Ultrasonography

Introduction

Acute abdominal pain or better known as acute abdomen is defined as tremendous severe pain arising in the abdominal area and requires immediate care. There is a lack of consensus on the overall incidence of the acute abdomen in the developing world, likely as a result of the range of locations which fall into this category (e.g., Southeast Asia, Sub-Saharan Africa, and Central America) in addition to various socioeconomic, dietary, cultural, and environmental differences. Many generalisations regarding acute abdomen are shared with those of developed nations, including acute appendicitis and intestinal obstruction, which account for up to 25 and 35% of all cases, respectively. Common causes of the acute abdomen based on quadrant are as follows (1).

1. Right Upper Quadrant - Cholecystitis, biliary colic, cholangitis, hepatitis, hepatic abscess, intestinal obstruction, peptic ulcer disease.

2. Left Upper Quadrant - gastritis, peptic ulcer disease, pancreatitis, splenomegaly, intestinal obstruction

3. Right Lower Quadrant - appendicitis, inflammatory bowel disease, diverticulitis, mesenteric adenitis, intestinal obstruction, ectopic pregnancy, salpingitis, ovarian torsion,

nephrolithiasis

4. Left Lower Quadrant - diverticulitis, intestinal obstruction, inflammatory bowel disease, ischemic colitis, ectopic pregnancy, salpingitis, ovarian torsion, nephrolithiasis.

Imaging plays a very important role in planning the early treatment and management of these patients because clinical evaluation results can be inaccurate. Thus the current study was undertaken to evaluate the use of ultrasonography in acute abdomen and to find out its sensitivity and specificity in the diagnosis as well as to correlate it with surgical/histopathological results, if required.

Material and Methods

The present study comprised of 100 patients presenting with acute non traumatic abdominal emergencies and subsequently subjected to USG examination after clinical examination. Patients with unstable vital signs, shock and trauma were specifically excluded from the study. The instrument used was ultrasound having a curvilinear probe of 3.5MHz - 5MHz or linear high frequency probe 7-12MHz. Based on sonographic findings provisional

From the Department of Radio-Diagnosis and Imaging, Govt. Medical College, Amritsar- (Punjab)-India

Correspondence to : Dr. Ramesh Chander, Associate Professor, Department of Radio-Diagnosis and Imaging, GMC Amritsar-(Pb) India

diagnosis was made. The final diagnosis was made on the basis of operative findings/therapeutic response/FNAC findings/Histopathological/Laboratory findings. The sonographic diagnosis was co-related to the surgical/histopathological findings in appropriate cases.

Results

In our study, the most common age of presentation was between 21 to 30 years followed by 31 to 40 years with mean age of about 28 years (Table 1). There were 62 males and 38 females with a male to female ratio of 1.63:1 (Table 2). Most of the patients presented with acute abdominal pain lasting from a few hours to a few days along with features such as nausea / vomiting / fever / hematuria / rigidity / or guarding. The most common cause of pain abdomen in our study was acute appendicitis followed by GIT cases. Out of 100 patients USG gave an accurate diagnosis in 87 cases (87%). On ultrasonography 31 cases were diagnosed as acute appendicitis, 19 cases were diagnosed as perforation of hollow viscus, 15 cases were diagnosed as intestinal obstruction, 7 cases were diagnosed as acute pancreatitis, 8 cases were diagnosed as acute cholecystitis, 1 case as choledocholithiasis, 4 cases as urolithiasis, 1 case as intussusception, 1 case as hemorrhagic ovarian cyst and in 13 cases, the conclusive diagnosis was not reached which can be contributed towards the limitation of the ultrasound. Based on final diagnosis after clinical / operative / histopathology findings and correlation, we had 36 cases of acute appendicitis, 22 cases of perforation of hollow viscus, 16 cases of intestinal obstruction, 10 cases of acute pancreatitis, 8 cases of acute cholecystitis, 1 case of choledocholithiasis, 4 cases of urolithiasis, 2 cases of intussusception and 1 case of hemorrhagic ovarian cyst (Table 3). In present study, the sensitivity and specificity for ultrasound in diagnosing acute appendicitis, perforation of hollow viscus, intestinal

obstruction and acute pancreatitis was around 86.1% and 83.3%, 86.3% and 80%, 93.7% and 80%, 70% and 75% respectively. For acute cholecystitis, urolithiasis, choledocholithiasis and hemorrhagic ovarian cyst, the corresponding sensitivity of ultrasonic diagnosis was 100% respectively. In case of intussusception the sensitivity of ultrasonography was as low as 50%. These variations in sensitivity can be explained due to small sample size of some of the etiologies.

Discussion

USG diagnosis was compared with the final diagnosis based on laboratory values, radiological findings, and operative findings. Out of 100 patients USG made a correct diagnosis 87 cases (87%). Ultrasound examination is highly accurate in diagnosing the exact cause of pain in patients presenting with acute abdominal conditions (2). Allemann *et al* (3) in his study described that in cases of patients with acute abdominal pain US improved the correct diagnostic rate from 348 (70%) to 414 (83%). In the same study, the diagnostic accuracy for acute appendicitis and biliary tract disease improved after US from 455 (92%) to 488 (98%) and from 463 (93%) to 490 (99%), respectively; the corresponding sensitivities and specificities were 91% and 99% and 94% and 99%. In our study, ultrasound was misleading in 13 cases where the conclusive diagnosis could not be reached at using ultrasonography alone. In these cases, the accurate diagnosis was obtained either at surgery or by using adjuvant and /or higher modalities such as CT scan. Out of the 36 confirmed cases of acute appendicitis, the ultrasound was able to detect 31 cases. All of them showed the inflamed appendix consistent with non compressible, blind ending tubular structure (Fig.1). Ultrasonography could not identify 5 cases, which were later on confirmed to be the cases of acute appendicitis on laparotomy. Out of these 5 cases, 2 cases were of

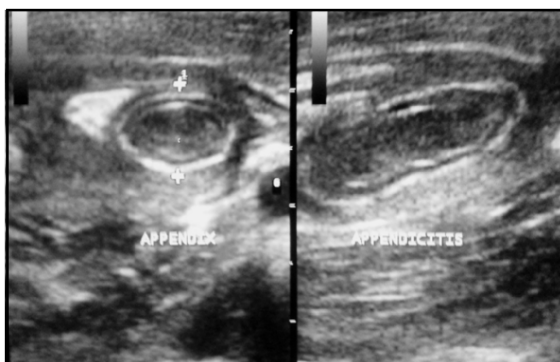


Fig 1. Inflamed Appendix is seen as a Non Compressible, Aperistaltic, Tubular Structure of Diameter Greater than 6 mm with a Blind end Arising from the Caecum

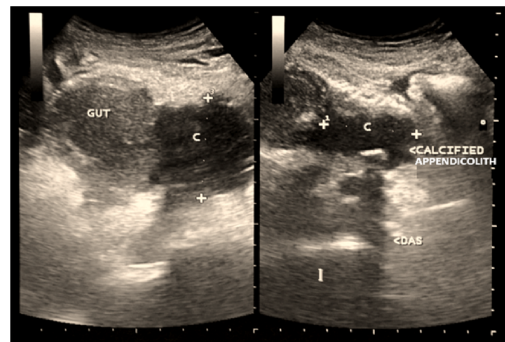


Fig 2. Sonographic Appearance as Seen in Case of Perforated Appendix. A loculated Hypoechoic Collection is Present in Relation to the Terminal Ileum and Caecum

Table 1. Showing the Age Distribution in 100 Cases of Non Traumatic Acute Abdominal Emergencies

Sr. No.	Age Group (years)	No. of cases	Percentage
1	0-10	5	5
2	11-20	11	11
3	21-30	29	29
4	31-40	17	17
5	41-50	16	16
6	51-60	13	13
7	>60	9	9
	TOTAL	100	100

Table.2 Showing Sex Distribution of the Study Cases

Sr. No.	Sex of the patients	No. of patients
1.	Males	62
2.	Females	38
	TOTAL	100

Table.3 Showing Cause of Acute Abdominal Pain in 100 Study Cases of Nontraumatic Acute Abdominal Emergencies

Sr. No.	Cause of Acute Pain Abdomen	No. Of Cases	Percentage
1	Acute Appendicitis	36	36
2	Perforation of Hollow Viscus	22	22
3	Intestinal Obstruction	16	16
4	Acute Pancreatitis	10	10
5	Acute Cholecystitis	08	08
6	Urolithiasis	04	04
7	Intussusception	02	02
8	Choledocholithiasis	01	01
9	Hemorrhagic Ovarian Cyst	01	01
	TOTAL	100	100

perforated appendix and in the remaining 3 cases, the appendix could not be visualised due to extensive bowel gas and patient's non-cooperation (Fig.2). The sensitivity and specificity for ultrasound diagnosis were 86.1% and 83.3%, respectively. Pacharn P, *et al* (4) in their study described the sensitivity of sonography to be 81.1% (30 of 37); and specificity to be 87.8% (137 of 156).

There were total 22 confirmed cases of perforation of hollow viscus. Most of the patients had fever and presented with a sharp and burning pain in the epigastrium and in the umbilical region. Out of these, 10 cases had rigidity and 12 had a fever at the time of presentation. The use of ultrasound could identify 19 out of 22 cases. Pneumoperitoneum was accurately identified in 18 out of 22 cases (Fig.3). Ultrasonography could not diagnosed 3 cases, which later on were confirmed on laprotomy to be a perforation of hollow viscus. 1 case was of perforation of malignant gastric ulcer and the remaining 2 cases were of distal ileal perforation, which were missed on ultrasonography. Ultrasound examination could accurately predict the location of perforation in 3 out 22 cases only. The sensitivity and specificity of diagnosis

with ultrasound were 86.3% and 80% respectively. Braccini G, *et al* (5) described a sensitivity of 86% and a specificity of 83.5% for the use of ultrasound in the diagnosis of perforation of hollow viscus. There were 16 confirmed cases of intestinal obstruction. Most of the patients presented with a progressive vague abdominal discomfort with distention of abdomen. In the remaining, there was an abrupt onset with colicky pain and rapid deterioration. Ultrasound was accurate in the diagnosis of 15 out of 16 cases in form of dilated, fluid filled aperistaltic bowel loops with coarse level intraluminal echoes (Fig 4). On follow up, 7 cases were operated after the clinical diagnosis of acute intestinal obstruction and on laprotomy these showed up as cases of mechanical obstruction-4 due to adhesions, 2 related to hernias and 1 due to caecal volvulus. In the remaining cases, only conservative treatment was done. In most of the cases of ileus in our series, the underlying cause could not be ascertained on ultrasonography. The sensitivity and specificity of diagnosis with ultrasound were 93.7% and 80% respectively. Schmutz GR, *et al* (6) evaluated the role of ultrasonography in the bowel obstruction and

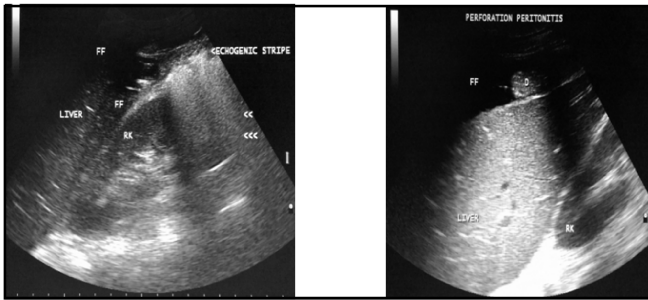


Fig 3. Sonographic Appearance of Perforation. The Free Intra-peritoneal Air Appears as Diffusely Echogenic Stripe with Dirty Posterior Shadowing.



Fig 5. Sonographic Appearance of Acute Pancreatitis With Heterogenous Echotexture with Multiple Intrapaneatic Echopoor Areas Representing Fluid Collections .

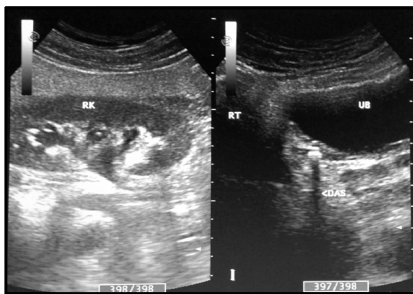


Fig 7. Ureterolithiasis. The Kidney shows Moderate Hydronephrotic changes. A well Defined Calculus with Distal Acoustic Shadowing at the Distal End of the Right Ureter

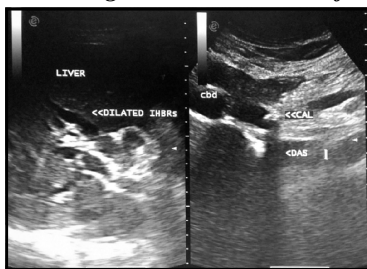


Fig 9. Sonographic Appearance in Cholelithiasis. The Intrahepatic Biliary Radicals are Markedly Dilated
 reported a sensitivity of 95% with an overall accuracy of 81.3%. In the present study, we had 10 confirmed cases of acute pancreatitis. Most of the patients presented with a classic pain in the epigastrium radiating to the back

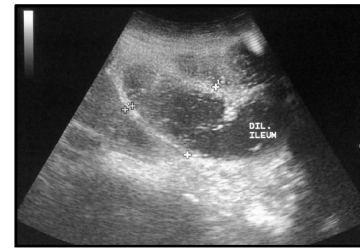


Fig 4. Small bowel obstruction. Multiple Dilated, Fluid Filled, Aperistaltic Bowel Loops are Present with a Caliber of Greater than 3.5 mm

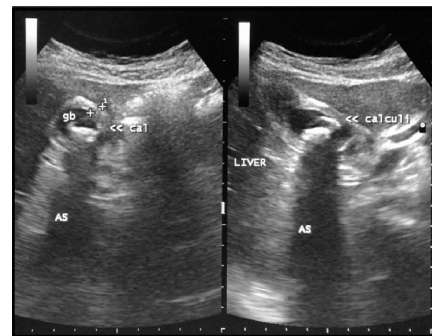


Fig 6. Sonographic Appearance of Acute Cholecystitis. Gall bladder Shows Multiple Calculi in its lumen along with Thickening and Edema of its wall.

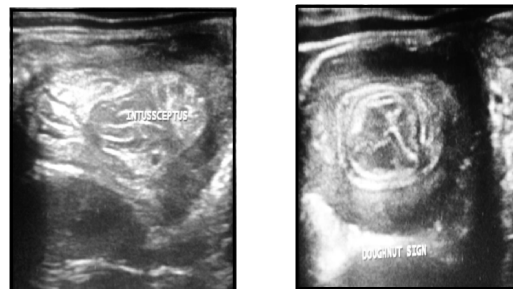


Fig 8. Sonographic Appearance in Intussusception. A Well Defined, Round Bowel Mass with Concentric Bowel Layers and a Diameter of 4.3 cm with target/ Doughnut Appearance

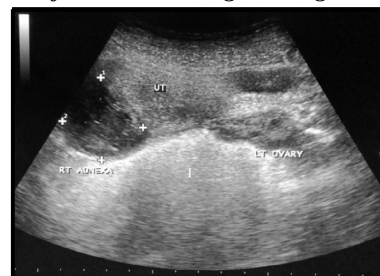


Fig 10. Hemorrhagic Ovarian Cyst. A well Defined Heterogenous Cystic Lesion with Internal Echoes is shown in Relation to Right Adnexal
 with associated symptoms of nausea and vomiting. Out of these 10 cases, ultrasonography was accurate in 7 cases which showed bulky pancreas with irregular margins

and peripancreatic/intrapaneatic fluid or edema (Fig 5). 3 cases that were not identified on ultrasonography, were of acute pancreatitis involving the tail region of the pancreas. It was due to the limitation of ultrasound and because of the extensive gas that the full length view of pancreas could not be obtained in these cases. In our series, the serum amylase levels in the patients with acute pancreatitis were elevated in 8 out of 10 cases. The sensitivity and specificity of diagnosis with ultrasound were 70% and 75% respectively. Wang SS, *et al* (7) found out the role of ultrasonography in acute pancreatitis and calculated a sensitivity of 71.8% and specificity of 98% for use of ultrasonography in acute pancreatitis. There were total 8 cases of acute cholecystitis in our series. Most of the patients were healthy middle aged females and presented with tenderness in right upper quadrant. Few of them had nausea and vomiting. All of these 8 cases were followed up and the diagnosis was confirmed post operatively. Plain X ray abdomen was done in all the cases, however only 1 case revealed multiple radio-dense opacities in the right hypochondrium. Ultrasound abdomen showed calculus/calculi in gall bladder lumen with dense posterior acoustic shadowing. The walls of the GB were thickened and edematous (Fig 6). The sensitivity of diagnosis on ultrasound was 100%. Ralls PW, *et al* (8) found that the positive predictive value for the GB calculi combined with the positive sonographic Murphy's sign was 92.2% and when along with the GB wall thickening, it was 95.2%. There were total 4 cases of urolithiasis that presented with colicky pain in the abdomen consistent with non traumatic acute abdominal emergencies. 3 cases had acute pain in groin with nausea and vomiting where as 1 case presented with colicky loin pain. Ultrasonography accurately diagnosed the cause of pain by demonstrating the obstructing ureteric calculus with proximal hydronephrosis in all 4 cases of urolithiasis (Fig 7). We obtained a sensitivity of 100% using ultrasound for diagnosing ureterolithiasis in a small sample. Park SJ, *et al* (9) found out that the overall sensitivity and specificity of ultrasound for detecting ureteric calculi was high, being 98.3% and 100% respectively. We had 2 confirmed cases of small bowel intussusception. Both cases presented with a rapid onset pain in the central part of the abdomen. 1 of them had fever, vomiting and blood in stools. Sonography showed a well defined round to oval lesion on transverse section with maintained gut signature. Central hypoechoic area with peripheral echogenicity giving doughnut sign. On longitudinal sections, there was herniation of a segment of a bowel loop into another segment giving telescope sign or trident sign (Fig 8) Out of these one case was accurately diagnosed with ultrasonography whereas the second case was not diagnosed on ultrasonography. The diagnosis was arrived at on higher modality (CT scan) in this case and confirmed on laprotomy. There was 1 case

of choledocholithiasis, which was accurately diagnosed by ultrasonography and later on confirmed by higher modalities and post- surgically. Ultrasound showed marked dilatation of intrahepatic and extrahepatic biliary radicals with a calculus at its distal end (Fig 9). This case presented with discoloration of skin and eyes due to jaundice along with fever and pain in the right side of the abdomen. The Liver function tests were highly elevated in this case. We had one case of hemorrhagic ovarian cyst in our series. The patient had a history of acute pelvic pain of short duration with tenderness in the lower abdomen. On ultrasonography, a well defined cystic lesion was seen in right adnexal region. Coarse level internal echoes with septations and layering was seen. Right ovary could not be seen separate from this mass. Left ovary and uterus were normal (Fig 10). The clinical features are not always decisive and accurate about the diagnosis of acute abdominal pain. Patient management is improved by the use of ultrasonography. This also strengthens the decision to operate and improve overall efficiency of the surgical units. This was also shown by McGrath and Keeling (10) in their study.

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