Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL13, ISSUE 08, 2022

Original research article

Reliability of ultrasound in diagnosing acute abdominal conditions requiring emergency surgery

Dr. Vijay BN
Associate Professor, Department of General Surgery, Sridevi Medical College and Hospital, Tumkur, Karnataka, India

Corresponding Author:
Dr. Vijay BN

Abstract
Most surgeons would prefer to operate within the first twenty-four hours from the onset of pain to avoid the onset of perforation and peritonitis. There are two reasons which may explain why cases are operated on later than this time period. Either the patient may not present with acute symptoms or the symptoms are atypical. Common conditions that may simulate acute appendicitis include but are not limited to: cholecystitis or perforated gallbladder, inflamed duodenal ulcer, perinephric abscess, renal infection, Meckel' s diverticulum, intestinal obstruction, ectopic pregnancy, ureteric colic or ovarian torsion. In this study 150 patients with various acute abdominal conditions who presented with various acute abdominal conditions underwent both sonological examination of the abdomen and laparotomy in this hospital were included. The sensitivity of ultrasound is the same whether the appendix is retrocaecal or preileal. The sensitivity of ultrasound is higher in case of a appendicular mass or abscesses though in this study the numbers are quite small to draw a definite conclusion.
Keywords: Sensitivity, ultrasound, acute abdominal conditions

Introduction
Frequently, the patient experiences a recent history of indigestion or gastritis a few days prior to the attack of appendicitis. Bowel habits may be irregular, with either constipation or diarrhea, especially in adolescents. A patient who presents with acute appendicitis may have intense pain that may begin in the umbilical area and move towards the right iliac area, with eventual extension throughout the abdomen.
Nausea, vomiting, and fever are usually present in the early stages of the attack, with subsequent loss of appetite. The degree of nausea and the frequency of vomiting depend on the amount of distention of the inflamed appendix and the reflex nervous susceptibility of the patient [1].
The critical element causing inflammation of the wall of the appendix is bacterial invasion. The usual bacteria organisms are colon bacilli and streptococci, two organisms which are commonly found in the intestinal tract.
Fever may initially be absent, but usually develops within twenty-four hours, followed with an elevated white blood count, which probably means that peritonitis has already begun. Extreme local tenderness, rigidity, or distention of the abdomen is usually experienced. When the appendix is acutely inflamed gaseous distention of the cecum may be present. This localized distention is due to the excessive formation of gases by the bacteria l decomposition of the cecum and appendix [2].
Most surgeons would prefer to operate within the first twenty-four hours from the onset of pain to avoid the onset of perforation and peritonitis. There are two reasons which may explain why cases are operated on later than this time period. Either the patient may not present with acute symptoms or the symptoms are atypical.
Common conditions that may simulate acute appendicitis include but are not limited to: cholecystitis or perforated gallbladder, inflamed duodenal ulcer, perinephric abscess, renal infection, Meckel's diverticulum, intestinal obstruction, ectopic pregnancy, ureteric colic or ovarian torsion [3].
Ultrasound in case of suspected appendicitis is done not to diagnose appendicitis but to rule out other problems like ureteric calculus, ovarian cyst etc.
Ultrasound is also useful in picking up complications of appendicitis like a appendicular mass, appendicular abscess etc.
Graded compression is used in evaluation of patients with right iliac fossa pain. Gentle progressive pressure is applied at the site of maximum tenderness using the ultrasound probe. This helps to displace the fat and the bowel [4].

Methodology
In this study 150 patients with various acute abdominal conditions who presented with various acute

ISSN:0975 -3583,0976-2833 VOL13, ISSUE 08, 2022

abdominal conditions underwent both sonological examination of the abdomen and laparotomy in this hospital were included.
The following type of patients were not considered:

- Children less than 12 years.
- Cases of acute abdomen operated in other departments like urology, gynecology etc.
- Patients who had already undergone a laparotomy in a outside hospital for the same or related problem.

A Surgical Resident who makes a provisional clinical diagnosis and also lists out the probable differential diagnosis assesses the patient initially in the Emergency Medicine Department.
He then asks for the necessary hematological, biochemical and radiological investigations.
The patient was subjected to a sonological examination of the abdomen and X-rays of the chest and abdomen only if the resident felt it was necessary.
A radiologist, using a GE ultrasound machine using 3.5I\1Hz and S:MH.z probes, performed all sonological examinations.
The sonologist at the time of examination is aware of the probable clinical diagnosis.
The treating surgeon correlates his clinical finds with the sonological, radiological and the laboratory findings and decides on the further management of the patient.
The final diagnosis is that made after laparotomy.

Results
Sensitivity of ultrasound in uncomplicated appendicitis

True positive:	14
False positive:	0
True negative:	NA
False negative:	24

Sensitivity of ultrasound in diagnosing acute appendicitis: 36.84%.
Predictive value of a positive sonological test: 100%.

Total Count in cases of acute appendicitis:
Increased: 25.
Normal: 13.

Sensitivity of total count in appendicitis: 65.78% Diagnosis of Complication is:

Cases Clinically	**Sonologically**		
Mass	2	1	2
Perforation	8	5	6

Diagnosis closest to final diagnosis was first reached after:
Clinical examination alone: 33 (68.75%).
Ultrasound: 3 (6.25%).
Laprotomy: 12 (25%).

Position of appendix to ultrasound

	Retrocaecal	**Others True+ve**	
Pre-ilea!	4(10.81%)	7(18.91%)	2(5.40°(o)
False-ve	8 (21.62%)	14 (37.83%)	2(5.40%)

Position of appendix could not be determined in some of the cases.
Sensitivity of ultrasound in a retrocaecal appendix: 33.33%.
Sensitivity of ultrasound in a preileal appendix: 33.33%.

Ultrasound in hollow viscus perforations

Number of cases:	33
Duodenal	19 (57.6%)
Jejuna!	3 (0.09%)
Heal	11(33.3%)

ISSN:0975 -3583,0976-2833 VOL13, ISSUE 08, 2022

Chest X-ray showing air under diaphragm

Total:	20
Duodenal	12
Jejuna!	
Ilea\	7

Ultrasound showed positive findings in: 27.
Pneumoperitoneum: 3.
Free fluid: 24.

Chest X-ray	Ultrasound	number of cases
-ve	+ve	8 (24.2%)
+ve	-ve	1(0.03%)
+ve	+ve	19 (57.57%)
-ve	-ve	5 (15.15%)

Sensitivity of chest x-ray: 60.06%.
Sensitivity of ultrasound: 81.81%.
Sensitivity of ultrasound based on pneumoperitoneum: 9.00%.
Sensitivity of ultrasound based on free fluid: 72.72%.

Ultrasound was
Uniquely diagnostic: 0 (0.00%).
Confirmed the primary diagnosis: 3 (9.0%).
Provided corroborative evidence: 24(72.72%).
Not diagnostic or misleading 6 (18.18%).

Diagnosis closest to the final diagnosis was reached after
Clinical examination: 27(81.81%).
Ultrasound: 2 (6.06%).
CT scan: 1 (3.03%).
Laparotomy: 3 (9.09%).

Ultrasound in abdominal injuries
Total number: 21.
Blunt: 20.

Penetrating
Solid Organ Injury: 12.
Hollow Viscus Injury: 8.
Diaphragm Injury: l.

Clinical diagnosis

Suspected	Turned out true	
Solid Organ	16	14 (87.5%)
Hollow viscus	4	3 (75%)

Ultrasound was
Uniquely diagnostic: 0.
Confirmed the primary diagnosis: 7.
Provided corroborative evidence: 2.
Nondiagnostic and misleading: 12.
Out of the 8 cases of hollow viscus perforation Ultrasound picked up: 0.
Ultrasound wrongly reported as solid organ injury: 2.

Out of the 12 cases of solid organ injury

Ultrasound Picked	
All organs injured	5
Some organs	3
None of organs	4

ISSN:0975 -3583,0976-2833 VOL13, ISSUE 08, 2022

Diagnosis Closest to final diagnosis was first reached after: Clinical
Impression: 2 (9.52%).
Ultrasound: 6 (28.57%).
CT scan: 2 (9.52%).
X-ray: l (4.76%).
Laprotomy: 10 (41.61%).

Ultrasound in intestinal obstruction
H"
Total Cases: 10
Small Bowel: 10
Large Bowel: 0

Congenital Bands	5
Intestinal Cocoon	3
Post op adhesions	
intussusception Out of the 10 cases	1

Clinical diagnosis of intestinal obstruction was made in 6 cases (60%) X-ray showed
Dilated loops and air fluid levels: 6 (60%).
Equivocal findings: 3 (30%).

Ultrasound findings
Dilated loops: 7(70%)
Free fluid: 2 (20%)
Equivocal: 1(10%)
Ultrasound was Uniquely diagnostic: 0.
Confirmed Primary Diagnosis: 7.
Provided corroborative evidence: 2.
Non-diagnostic/misleading: l.

Diagnosis Closest to final diagnosis was first reached by:

Clinical Impression alone	6 (60%)
Ultrasound	0
X-ray	2 (20%)
Laprotomy	2 (20%)

Ultrasound in Mesenteric Ischemia/Bowel Gangrene

Total Cases	11
Ileocaecal junction	2
Colon	2
Small Bowel	7

Out of the 11 cases only one case was suspected to be mesenteric ischemia All other cases were thought to be hollow viscus perforation.
X-ray airfluid levels: 7 (63.64%).
Equivocal: 4 (36.36%).

Ultrasound
Dilated Loops: 2 (18.18%)
Dilated Loops and free fluid: 5 (45.45%).
Equivocal: 4 (36.36%).

Ultrasound was
Uniquely diagnostic: 0.
Confirmed the Primary Diagnosis: 0.
Provided Corroborative evidence: 7 (63.64%).
Non-diagnostic/misleading: 4 (36.36%).

ISSN:0975 -3583,0976-2833 VOL13, ISSUE 08, 2022

Diagnosis closest to the final diagnosis was first reached after
Clinical Impression alone: l (9.09%).
Ultrasound: 0.
Laprotomy: 10 (90.90%).

Ultrasound in cholecystitis (and complications)
Number of cases: 12.
Acute Cholecystitis: 7.
Empyema Gall bladder: 4.
Perforation: 1.

Out of the 7 cases of acute cholecystitis, clinically
Primary diagnosis of cholecystitis: 3 (42.85%).
Differential diagnosis: 4 (57.14%).

Ultrasound was
Uniquely diagnostic in: 1(8.33%).
Confirmed the Primary Diagnosis: 4 (33.33%)
Provided Corroborative Evidence: 7 (58.33%).
Non-diagnostic/misleading: 0.

Ultrasound how ever could not directly diagnose complications in the 4 cases
Diagnosis closest to the final diagnosis was reached by:
Clinical impression alone: 3 (25.00%).
Ultrasound: 5 (4 1.66%).
Laprotomy: 4 (33.33%).

Ultrasound in other abdominal conditions
Pelvic Abscess: 5.
4 were suspected on clinical examination and all 5 were diagnosed on ultrasound.

Ruptured Liver Abscess: 3.
2 were suspected to be hollow viscus perforation on clinical examination Ultrasound could pick up the rupture in one and only the abscess in the other 2.

Miscellaneous
This includes conditions like pancreatitis, Meckel's diverticulitis, disseminated tumours with peritoneal metastases.
Ultrasound could not diagnose any of the conditions and all were detected on laparotomy.

Discussion
The main difficulty encountered in this study has been that ultrasound, like clinical diagnosis, is a very subjective investigation. Though attempt has been made to minimize this by considering diagnosis made by consultants only, the observer variation between consultants cannot be eliminated.
The other difficulty is that the sensitivity and specificity of ultrasound can vary at different stages of the disease. E.g. ultrasound may pick up an appendicular abscess more easily than just appendicitis. Attempt has been made to study the reliability of ultrasound in detecting these complications wherever feasible.
Appendicitis and hollow viscus perforation constitute the 2 commonest causes of acute abdomen which require emergency laparotomy. In this study too these two conditions have formed the bulk [4].
Acute Cholecystitis is a common cause for acute abdomen., but in this study there have been only 12 patients with these problems. This is because most of the patients present 3-4 days after the onset of pain. These patients are conservatively managed and called for an elective cholecystectomy.
All patients with blunt abdominal undergo an initial sonological examination and if the patient is hemodynamically stable and there is no suspicion of a hollow viscus perforation these patients are subjected to a CT scan of the abdomen for accurate grading of the injury and to plan further management.
There have been a few patients with primary peritonitis and pelvic abscess included in this study.
There was one patient with acute pancreatitis who underwent a laparotomy for a mistaken diagnosis of colonic perforation.
As the results show clinical examination alone has a high sensitivity in diagnosing appendicitis. But the main draw back here i s that there is a tendency among residents to diagnose all right iliac fossa pain as appendicitis. As the number of false positive clinical diagnosis of appendicitis is not available in this

ISSN:0975 -3583,0976-2833 VOL13, ISSUE 08, 2022

study it i s not possible to conclude that laparotomy be done on clinical impression alone [6].
The fact that ultrasound did help in 3 out of the 8 cases of clinically doubtful I unsuspected cases of appendicitis is a point in favour of doing routine ultrasound though it has a low sensitivity. One particular case which drives home this point is that of a primigravida who came with right iliac fossa pain and was admitted in the obstetric ward with a suspected diagnosis of threatened abortion. The surgery consultant missed the diagnosis till ultrasound confirmed that the appendix was inflamed.
The other striking feature is the 100% positive predictive value of ultrasound. Appendicitis has quite often been missed on ultrasound but whenever detected it has always been true even when the laboratory investigations have not been in favor.
Many surgeons diagnose appendicitis based on the total count. Though the sensitivity of this investigation is much higher than that of ultrasound the specificity remains to be studied.
The sensitivity of ultrasound is the same whether the appendix is retrocaecal or preileal.
The sensitivity of ultrasound is higher in case of a appendicular mass or abscesses though in this study the numbers are quite small to draw a definite conclusion.
Traditionally ultrasound has been considered to be of very limited value in cases of hollow viscus perforation.
The sensitivity of chest x-ray in this study has been around 60% which is in league with that mentioned in other studies.
Ultra sound has been found to have a higher sensitivity than x-ray but this is only when indirect evidence like presence of free fluid is taken into consideration. When only direct evidence like pneumoperitoneum is considered the sensitivity reduces. Again without calculating specificity it is impossible to conclude the superiority of one investigative modality over the other as seen there a high number of cases where x-ray findings have been negative and ultrasound has still detected free fluid. Hence clinical signs with free fluid on ultrasound is a strong indicator of hollow viscus injury even in the absence of air under the diaphragm.
The final diagnosis of hollow viscus perforation has quite often been reached on clinical impression alone.
One particular patient had a clinical suspicion of pancreatitis. As both, investigations and ultrasound was equivocal CT scan was done and this showed leak of oral contrast into the peritoneal cavity.

Conclusion

Ultrasound can be useful in cases of hollow viscus perforation as it can provide corroborative evidence even in cases where there is no air under the diaphragm. Ultrasound is not very reliable in evaluating blunt abdominal l trauma and mesenteric ischemia.
The main limitation encountered in this study is inability to calculate specificity as the number of true negative cases is not available.

References

1. Rose JS, Levitt MA, Porter J, Hutson A, Greenholtz J, F Nobay F, *et al*. Does the presence of ultrasound really affect computed tomographic scan use? a prospective randomized trial of ultrasound in trauma J Trauma. 2001;51(3):545-50.
2. Schwerik WB, Wicktrup B, Rothmund M, Ruschoff J. Ultrasound in the diagnosis of acute appendicitis. Gastroenterology. 1989;97:630-639.
3. Udobi KF, Rodriguez A, Chiu WC, Scalea TM. Role of ultrasonography in penetrating abdominal trauma: a prospective clinical study. J Trauma. 2001;50(3):475-9.
4. Walsh PF. The value of immediate use of ultrasound in acute abdominal conditions-a critical apprisal Clinical Radiol. 1990;42:47-49.
5. William LF. Mesenteric ischemia Surg. Clinics of North Am. 1988;68:331-353.
6. Williams RJ, Windsor AC, Drosin R. Ultrasound scanning of the acute abdomen by surgeons in training Ann. R. Coll. Surg Engl. 1994;76:228-233.

Accepted on 10/01/2022