



Acute Abdomen - Comparison of Emergency Ultrasound Abdomen and Laparotomy Findings - A Prospective Study

KEYWORDS

Acute abdomen, laparotomy, Ultrasound

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ABSTRACT *Acute abdomen is one of the most important surgical emergencies encountered in clinical practice. With a variety of possible differential diagnosis, acute abdomen presents a challenge to the emergency surgeon. Following clinical examination, ultrasound forms the first stay of investigation in many settings. This study aims to establish the usefulness of ultrasonography in cases of acute abdomen by comparing it with the laparotomy findings.*

INTRODUCTION

The term acute abdomen refers to a sudden, severe abdominal pain of uncertain etiology that is less than 24 hours in duration and usually needs surgical operation. Acute abdomen encompasses a wide range of surgical, medical and gynecological conditions accounting for 5-10% of all emergency admissions. The causes of abdominal pain can range from benign self-limiting conditions to acute life threatening disorders, thus needing a methodical evaluation and rapid and accurate diagnostic work up.

Clinical examination in the case of acute abdomen though indispensable is sometimes unreliable, making imaging modalities necessary in today's world of evidence based medicine. Ultrasonography (USG) is the most commonly ordered investigation by a surgeon in a case of acute abdomen as it provides a safe, rapid, cost effective and repeatable evaluation of liver, gall bladder, bile ducts, spleen, pancreas, appendix, kidney, ovaries, adnexa and uterus. USG, being operator dependent, is not fool-proof making it necessary for the surgeon to keep an open mind and correlate clinical findings with the USG findings.

This study aims to understand the value of ultrasonography as an adjunct to the clinical diagnosis prior to surgery by comparing the emergency ultrasound and intra operative findings.

ULTRASOUND:

The potential application of ultrasound as an imaging modality was noticed as early as the late 1940s when it was being utilized in sonar and radar technology. In the early 1950s, John Reid and John Wild in Minnesota developed a prototype B-mode ultrasonic imaging device and demonstrated the capability of ultrasound for imaging and characterization of cancerous tissues².

The major form of ultrasonic imaging is pulse-echo mode with the principle similar to that of sonar and radar. That is, following an ultrasonic pulse transmission, echoes from the medium being investigated are detected and used to form an image. Although pulse-echo ultrasound had been used to diagnose a variety of medical problems since the 1950s, it did not become a widely accepted imaging tool until the early 1970s when gray-scale ultrasound with nonlinear echo amplitude to gray level mapping was introduced².

Today, ultrasonography is the second most employed diagnostic imaging modality in the field of medicine, second only to conventional X-ray.

ACUTE ABDOMEN:

Jones S.R. describes the term acute abdomen as "symptoms and signs of intra-abdominal disease usually treated best by surgical operation". The general rule for acute abdominal pain is that which appears in a previously healthy individual and may require surgical intervention.

SURGICAL ACUTE ABDOMINAL CONDITIONS

- Infection:** Appendicitis, Cholecystitis, Meckel's diverticulitis, Hepatic abscess, Diverticular abscess, Psoas abscess
- Perforation:** Perforated gastrointestinal ulcer, Perforated gastrointestinal cancer, Boerhaave's syndrome, Perforated diverticulum
- Obstruction:** Adhesion related small or large bowel obstruction, Sigmoid volvulus, Cecal volvulus, Incarcerated hernias, Intussusception
- Ischemia:** Mesenteric thrombosis or embolism, Ovarian torsion, Ischemic colitis, Testicular torsion, Strangulated hernias
- Hemorrhage:** Solid organ trauma, Leaking or ruptured arterial aneurysm, Ruptured ectopic pregnancy, Intestinal ulceration, Hemorrhagic pancreatitis, Mallory-Weiss syndrome

CLINICAL FEATURES AND USG FINDINGS OF ACUTE ABDOMEN

1. ACUTE APPENDICITIS

Acute appendicitis is the most commonly presenting acute abdominal condition in emergency departments. It can present at all ages, although it occurs more frequently during the 2nd and 3rd decades of life.

Clinical Presentation:

The typical presentation begins with peri-umbilical pain followed by anorexia and nausea. The pain then localizes to the right lower quadrant. A bout of vomiting may occur. Fever ensues, followed by the development of leukocytosis.

Ultrasonography: Inflamed appendix

- Non compressible

- Non concentric
- Restricted mobility
- Faecolith may be detected in 30% of cases

Detecting complications of appendicitis

- Perforation: presence of a large amount of free fluid in the surrounding region; prominent para-caecal fat and thickening of the mesentery
- Phlegmon: Large mass of non-compressible fat surrounding the appendix scattered with echo-poor streaks
- Abscess: Circumscribed para-appendicular fluid collection. Air may be present within the fluid collection and surrounding bowel may be thickened

2. INTESTINAL PERFORATION

Intestinal perforation has a variety of causes. The main causes can be divided into three groups: (a) benign conditions, as appendicitis, ulcerations, Meckel's diverticulum, diverticulitis, volvulus, intussusception, (b) malignant disease, as small bowel and colon tumors, and (c) other situations, as foreign bodies, iatrogenic injuries (after colonoscopy, or endoscopic polypectomy), and inflammatory bowel diseases.

Common symptoms and signs of intestinal perforation are fever, nausea, severe pain (localized or all over the abdomen), distension of abdomen, rebound tenderness, vomiting, dizziness, paleness, tachycardia, hypotension and absence of enteral sounds. The patient's condition worsens with time.

Ultrasonography:

In peptic ulcer, ultrasound demonstrates asymmetric thickening of the duodenal wall with presence of air extending from the duodenal lumen to the periphery of the wall or even into the adjacent inflamed tissues. In case of perforation, an air-track can be visualized from the ulcer to the peritoneal cavity usually in upward direction. Free air is best seen in left decubitus position between the liver and right abdominal wall. Free fluid is usually present in the abdomen containing food particles and air bubbles.

3. ACUTE INTESTINAL OBSTRUCTION

Bowel obstruction occurs when the normal flow of intestinal contents is disturbed by a mechanical blockage. Approximately 75% of cases of small bowel obstruction are the result of adhesive peritoneal bands in patients with a history of abdominal surgery¹. Hernias are the second most common cause of SBO and account for up to 25% of cases.

Clinical Features: The primary symptoms of intestinal obstruction include intermittent colicky abdominal pain, nausea, vomiting, abdominal distention, and obstipation. The typical crampy abdominal pain is seen in paroxysms at 3 to 5 minute intervals and occurs less frequently with distal obstruction. Nausea and vomiting are more common with a proximal obstruction. Distension of abdominal is seen as the obstruction persists, and the intestine proximal to the site of obstruction becomes increasingly dilated.

The patient may present with tachycardia and hypotension, suggesting severe dehydration. Fever suggests the possibility of strangulation. Initially, peristaltic waves can be observed, particularly in thin patients. Abdominal tenderness is usually present with or without a palpable mass. However, rebound tenderness, voluntary guarding and rigidity will suggest peritonitis and the likelihood of strangulation should be considered. Auscultation may initially demon-

strate hyperactive bowel sounds with audible rushes associated with vigorous peristalsis which soon disappear as the obstruction progresses.

Ultrasonography: Ultrasound is useful in obstruction, by demonstrating dilated, fluid filled bowel loops with ineffective peristalsis. These fluid-filled loops of bowel are highly amenable to ultrasound scanning, which has the advantage of being able to visualize peristalsis directly, unlike a plain X-ray. It is possible to trace the dilated bowel to the site of obstruction by visualizing peristalsis, distal to which are normal loops of collapsed bowel.

4. ABDOMINAL TRAUMA

The abdomen is routinely evaluated for injuries after trauma, both blunt and penetrating. Approximately a quarter of all trauma victims end up needing abdominal exploration. Clinical evaluation of the abdomen by means of physical examination is inadequate to identify intra-abdominal injuries because of the high number of patients with altered mental status secondary to head trauma, alcohol, or drugs and because of the inaccessibility of the pelvic, upper abdominal and retroperitoneal organs to palpation.

Ultrasonography: The objective of ultrasound evaluation is to search for free intraperitoneal fluid. It can be done expeditiously and is as accurate as DPL in detecting hemoperitoneum. It can also evaluate the liver and the spleen once free fluid is identified.

Free fluid usually appears as a hypoechoic region within the peritoneal cavity or pelvis and is usually linear or triangular in shape. The shape depends on its compression by the surrounding tissues. For instance, in Morison's pouch, the fluid between the liver and kidney gives a linear shape. Fluid surrounding bowel often appears triangular. Fluid often accumulates at the site of injury and then flows throughout the abdomen and collects in the pelvis. Near the site of injury, the blood may appear echogenic as it forms a clot adjacent to the injured organ².

MATERIALS AND METHODS

This study was conducted in the department of General surgery, OSMANIA GENERAL HOSPITAL, HYDERABAD on patients presenting with features of acute abdomen and requiring emergency surgical intervention during the period from November 2011 to October 2013.

The data pertaining to history, clinical examination and ultrasonography findings of the patients attending emergency surgical ward, Osmania general hospital is collected. The collected data includes preoperative emergency ultrasound abdomen findings along with the intra operative findings. The total number of cases included in the study was 80.

As part of the general work up for surgery random blood sugar, blood urea, serum creatinine, serum electrolytes, hemoglobin percentage, chest x ray, ECG were done for the patients. X ray erect abdomen was done for those patients with clinical suspicion of acute intestinal perforation and obstruction.

After thorough clinical examination and establishing provisional diagnosis, Emergency ultrasound abdomen examination has been done by the duty radiologist. Immediate laparotomy has been done.

The ultrasound findings are then compared with intra operative findings and assessed statistically.

INCLUSION CRITERIA

Patients above 14 years of age
All patients underwent emergency laparotomy

EXCLUSION CRITERIA

Patients below 14 years of age
Pregnancy and gynecological disorders

CRITERIA FOR INTRA OPERATIVE DIAGNOSIS:

1. Acute appendicitis – Inflamed appendix, catarrhal appendix, fecoliths, hypertrophied mesoappendix.
2. Peritonitis due to perforation – Free fluid in the peritoneal cavity and presence of perforation.
3. Intestinal obstruction- Dilated bowel loops, strictures, adhesions, growth.
4. Abdominal trauma- Solid organ injury (liver and spleen etc.), hollow viscus perforation.

RESULTS AND OBSERVATIONS

The total number of cases evaluated in the present study is 80 which were admitted in the emergency ward of General Surgery department in Osmania General Hospital, Hyderabad from Nov 2011 to Oct 2013.

EMERGENCY USG FINDINGS:

S.N	USG Findings	No.	M	F
1	Peritonitis (hollow viscous perforation)	26	21	5
2	Dilated bowel loops (Intestinal obstruction)	16	9	7
3	Blunt injury abdomen (hemoperitoneum)	8	5	3
4	Stab injury	3	2	1
5	Acute Appendicitis	13	7	6
TOTAL :		66	44	22

Out of 80 cases Emergency Ultrasound Abdomen established diagnosis in 66 cases and in remaining 14 cases reported as normal study or other pathology.

LAPAROTOMY FINDINGS:

S.N	Diagnosis	No	M	F	%
1	Hollow viscus Perforation	29	23	6	36.25%
2	Intestinal obstruction	19	11	8	23.75%
3	Blunt injury abdomen	10	7	3	12.50%
4.	Penetrating injury abdomen	03	2	1	3.75%
5	Appendicitis and its complications	16	9	7	20%
	6 Others	03	3	0	3.75%
TOTAL		80	55	55	100%

Final diagnosis concluded by Laparotomy findings in 80 cases. Out of 80 cases, emergency USG abdomen established diagnosed in 66 cases, remaining cases further evaluated and operated immediately. Majority of cases in this study are peritonitis followed by intestinal obstruction and appendicitis.

COMPARISON OF USG AND LAPAROTOMY FINDINGS:

S.N	Diagnosis	US Findings	Lap Findings
1	Peritonitis	26	29
2	Intestinal obstruction	16	19
3	Blunt injury abdomen	8	10
4	Stab injury	3	3
5	Acute Appendicitis	13	16
6	Others	0	3
TOTAL :		66	80

COMPARISON OF EMERGENCY USG WITH LAPAROTOMY FINDINGS IN ALL THE CASES IN THIS STUDY:

Ultrasound	Laparotomy Findings		
	Positive	negative	
Positive	63	3	66
Negative	14	0	14
TOTAL	77	03	80

Sensitivity of USG: 81.81% Positive predictive value: 95.45%

DISCUSSION

Acute abdomen is a challenge for the clinician and sonologist both to arrive at an accurate diagnosis. In the present study, incidence of acute abdomen was common in age group between 26-45 years, mainly due to peritonitis caused by hollow viscus perforation followed a by younger age group of 15-25 years due to acute appendicitis.

I. HOLLOW VISCUS PERFORATION:

Emergency ultrasound abdomen was able to identify 86% of all cases of hollow viscus perforation. According to a previous study regarding clinical signs of peritonitis, an ultrasound finding of free fluid was a strong indicator of hollow viscous perforation.

One case of pelvic abscess was misdiagnosed by the radiologist as having a hollow viscous perforation.

II. BLUNT ABDOMINAL TRAUMA:

Blunt injury abdomen was the commonest type of abdominal injury seen in department of general surgery in Osmania General Hospital. Among the laparotomies carried out in all the patients with blunt injury abdomen, only in 84.6% cases emergency ultrasound findings are similar with laparotomy findings.

III. INTESTINAL OBSTRUCTION:

In the present study emergency ultrasound abdomen was able to identify 78.94% of all cases of intestinal obstruction. However, emergency ultrasound abdomen has limited role in diagnosing intestinal obstruction, as the major drawback of USG abdomen is not being able to identify the cause of obstruction.

IV. ACUTE APPENDICITIS:

In the present study emergency ultrasound abdomen is able to diagnose in 75% of all cases of acute appendicitis. But clinical diagnosis correlated with intra operative findings in all cases of acute appendicitis, as the major drawback was tendency to over diagnose all the cases of Right iliac fossa pain as appendicitis.

Many surgeons diagnose the appendicitis based on leukocyte count. Ultra sound will helpful in cases of clinically doubtful cases of acute appendicitis.

CONCLUSION

Acute abdomen is a syndrome of sudden onset that affects the abdominal cavity and is generally accompanied by pain and other abdominal symptoms⁴. Its severity and rapid progression demand prompt, systemic evaluation and many cases surgical intervention

In the process of diagnosis of acute abdomen which requires surgical intervention, first and foremost importance is given to clinical diagnosis based on history and clinical examination, followed by ultrasound examination. Ultra-

sonography is a helpful adjunct for clinical diagnosis confirmation and preventing delay in subsequent surgical intervention.

In cases of hollow viscus perforation, ultrasound provides corroborative evidence like the presence of free fluid diagnosing peritonitis. In cases of acute intestinal obstruction, ultrasound can detect the presence of dilated, air fluid filled bowel loops in high percentage of cases. But it fails to provide any clue regarding the probable cause of obstruction.

In conclusion, emergency ultrasound abdomen is a useful imaging modality in diagnosing acute abdomen. It continues to be first line investigation for surgeon to evaluate acute abdomen which need surgical intervention

SUMMARY

In this present study 80 patients were admitted in the department of General Surgery, Osmania General Hospital, Hyderabad with complaints of acute abdomen. The patients were evaluated with ultrasonography and underwent laparotomy subsequently.

The role of emergency ultrasound abdomen in the diagnostic accuracy and management of patients with acute abdomen compared with the laparotomy findings.

Results showed that emergency ultrasound abdomen had combined sensitivity of 81.8% and positive predictive value of 95.4%. In acute appendicitis ultrasound abdomen had low sensitivity (75%), but high predictive value (92.3%). But ultrasound is useful in easily identifying the complications of appendicitis. Ultrasound had sensitivity of 86.2% in identifying the hollow viscus perforation. In ultrasound had sensitivity of 78.9% in identifying intestinal obstruction and 84% of sensitivity in identifying hemoperitoneum in blunt trauma abdomen.

Based on this study it was concluded that emergency ultrasound abdomen has been useful first line investigation in acute abdomen which require surgical intervention. A positive ultrasound report of appendicitis was quite reliable while negative report was not and ultrasound provided corroborative evidence in case of bowel perforation and intestinal obstruction

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