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Original Research Paper

Radiodiagnosis

CAN ULTRASOUND ALONE SUFFICE IN THE EVALUATION OF ACUTE ABDOMEN IN ADULTS – A COMPARATIVE COMPUTED TOMOGRAPHY VERSUS ULTRASOUND (HOSPITAL BASED) STUDY

Dr Vishal Gupta	Head Of Department And Professor Of Department Of Radio-diagnosis, Sharda Hospital Greater Noida, India.
Dr Swati Awasthi*	Resident Of Department Of Radio-diagnosis, Sharda Hospital Greater Noida, India.*Corresponding Author
Dr Vaibhav Jaiswal	Resident Of Department Of Radio-diagnosis, Sharda Hospital Greater Noida, India.
Dr Mallika Gupta	Resident Of Department Of Radio-diagnosis, Sharda Hospital Greater Noida, India.

ABSTRACT

OBJECTIVE The objective of this study was to study the role of ultrasound and computed tomography in evaluation of acute abdomen and to assess whether ultrasound alone will suffice in majority situations, so that radiation exposure may be minimized.

MATERIALS AND METHODS This institutional review board approved prospective observational study comprised of 50 adult patients attending the emergency department for non-traumatic acute abdominal pain less than 3 days of duration. The radiological evaluation with US and CT scan (Non contrast and contrast enhanced) of abdomen was done at radiology department of Sharda hospital. The exclusion criteria were trauma and pregnancy. The equipments used were Ultrasound with color Doppler PHILIPS EPIQ 7G and CT Scan - GE Optima 660 - 128 slice CT Scanner with slice thickness of 0.6 mm.

RESULTS The overall sensitivity of US was 74% and that of CT was 96.15% with insignificant difference (p value – 0.018). Also, the sensitivity of US compared to CT in diagnosing common etiologies of acute abdomen namely acute cholecystitis, acute appendicitis, intestinal obstruction, pancreatitis and ureteric calculi sensitivity did not differ significantly. CT was necessary only in patients with retro-caecal appendicitis, bowel obstruction cases for defining the transition point and in patients with pancreatitis to obtain the CT Severity index.

CONCLUSION We propose that US should remain the primary imaging modality in all patients of acute abdomen in order to prevent radiation exposure, especially as it was found to have a sensitivity comparable to CT, in majority of the clinical situations. Moreover, it is a more cost-effective investigation. Therefore, CT should be reserved only for the minority of clinical situations where US is significantly inconclusive.

KEYWORDS :

INTRODUCTION

Acute abdomen is an emergency condition, in which patients present with recent onset of pain abdomen with accompanying signs and symptoms that focus on an abdominal condition.[1]

Acute abdominal pain may be caused by various clinical conditions such as acute appendicitis, diverticulitis, cholecystitis, intestinal obstruction, visceral perforation, mesenteric ischemia. Common symptoms with which a patient may present include vomiting (bilious or non-bilious), abdominal distension, fever, jaundice, constipation in addition to other signs and symptoms.[2]

The sudden occurrence of extreme abdominal pain that characterizes the "acute abdomen" requires immediate life-threatening pathology detection to provide timely curative strategy. The role of conventional radiography has been exceeded in patients with acute pain in the abdomen and this technique has only a role in patients with obstructed intestines.[3]

Ultrasound is the initial imaging modality in most patients because of its advantages like low cost, portability, wide availability and lack of ionizing radiation.[4] In emergency setting a possible strategy is to perform USG as the initial technique in all patients with acute abdominal pain; while CT can be performed in cases not diagnosed with USG.[5]

CT Scanning because of its excellent soft tissue contrast, spatial resolution and operator independence is advantageous in the emergency setting for patient diagnosis and management. Radiation exposure is a disadvantage of CT. The effective radiation dose for abdominal CT is approximately 10 mSv.[6] The radiation risk should be weighed against the direct diagnostic benefit before going in for CT examination of acute abdomen.[6]

The diagnostic value of imaging modalities is often expressed in terms of its clinical utility like – Diagnosis in a case whose clinical examination is inconclusive, Confirmation of diagnosis Change in diagnosis based on the imaging findings. Our study aimed to study the role of ultrasound and computed tomography in evaluation of acute abdomen and to assess whether Ultrasound alone will suffice in majority situations, so that radiation exposure may be minimized.

AIM

To study the role of ultrasound and computed tomography in evaluation of acute abdomen and to assess whether ultrasound alone will suffice in majority situations, so that radiation exposure may be minimized.

MATERIAL & METHOD

Study design: institutional review board approved prospective observational study.

Sample size: 50 adults.

Period of study: 6 months (1st january 2020 to 30th June 2020)

INCLUSION CRITERIA

Patients presenting with non-traumatic and non-obstetric acute abdominal pain of duration 24 hours or less

METHODOLOGY-

Clinical history and examination findings were recorded in patients with acute pain in abdomen at Sharda Hospital, Greater Noida and a provisional clinical diagnosis of acute abdomen was made by the treating doctor. To find the

possible cause, the patients were referred to radiology department for USG and/or CT Scan whole abdomen. Ultrasonography was performed and its findings correlated with provisional clinical diagnosis. CT scan was performed in patients in whom ultrasound could not yield a definitive diagnosis or when the clinician had referred the patients for CT whole abdomen to obtain further information regarding the diagnosis made on ultrasound. CT scan findings were also correlated with provisional clinical diagnosis. Cases in which the cause for acute abdomen could not be identified on USG/CT scan were labeled as inconclusive. Diagnosis made by USG and CT were compared with confirmed final diagnosis, which was made on the basis of follow up and post-operative findings in patients who underwent surgical management.

EQUIPMENTS

- Ultrasound with color Doppler PHILIPS EPIQ 7G
- CT Scan - GE Optima 660 - 128 slice CT Scanner with slice thickness of 0.6 mm. Isotropic imaging will be done and images were viewed in all three planes simultaneously on AW Volume Share 7 workstation.
- Contrast Material - Non-ionic contrast (e.g. Iohexol) was used in our study for iv administration. Water soluble contrast (Urograffin) was used for oral bowel opacification. Continuous monitoring for vital parameters was done during contrast injection.

Table 1: CT protocol of Abdomen

KV / effective mAs / rotation time	120 / 200 / 0.5 seconds
Detector collimation	0.625 mm
Slice Thickness	0.625 mm
Pitch	1
Image order	Cranial to caudad. Image from above diaphragm to pubic symphysis.
Oral Contrast	20 ml of urograffin 76% diluted in 980 ml of water given in 3 doses. 2 doses are given 1 hour prior and 30 min prior to the scan and one table dose is given just before the scan
Intravenous Contrast	1-2 ml/kg omnipaque (350 mg of iodine/ml)
Scan Delay	60 seconds

STATISTICAL ANALYSIS

All the patient demographic details are recorded in Microsoft excel and subjected to statistical analysis using SPSS v21 operating on windows 10. All the descriptive statistics are presented using tabulations, graphs and charts and analytical statistics as proportions and percentages. Sensitivity of ultrasound with comparison to CT scan is analysed. A p-value of <0.05 was considered statistically significant.

RESULTS

The present prospective study included total of 50 patients who presented to emergency department with acute abdomen pain and fulfilled the inclusion criteria. Participants were included in the present study after obtaining informed consent. Ultrasound was the first imaging investigation done in these patients. CT abdomen and pelvis was done for those patients in whom ultrasound could not yield a definitive diagnosis or when the clinician had referred the patients for CT abdomen and pelvis to obtain further information regarding the diagnosis made on ultrasound.

Among all 50 patients, 35 were males and 15 were female patients (male preponderance with male to female ratio of 2.3:1. The mean age of the participants was 39.38 years.

The most common disease conditions causing acute abdomen in our study were found to be intestinal obstruction (10/50) followed by acute calculous cholecystitis (9/50) and acute appendicitis (9/50) followed by acute pancreatitis (8/50) and ureteric colic (7/50). Other causes for acute abdomen included bowel perforation, pelvic inflammatory disease and aneurysm.

Table 2: Spectrum of Conditions causing acute abdomen

	Frequency	Percent (%)
INTESTINAL OBSTRUCTION	10	20.0
ACUTE APPENDICITIS	9	18.0
ACUTE CHOLECYSTITIS	9	18.0
ACUTE PANCREATITIS	8	16.0
URETERIC COLIC	7	14.0
BOWEL PERFORATION	2	4.0
PELVIC INFLAMMATORY DISEASE	2	4.0
WORM INFESTATION	1	2.0
PYELONEPHRITIS	1	2.0
ANEURYSM	1	2.0
Total	50	100.0

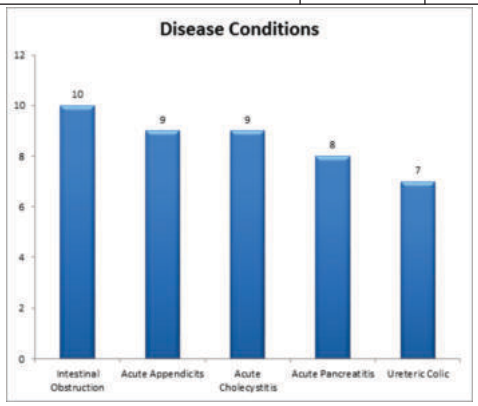


Figure 1: Most Common Disease Conditions causing Acute Abdomen

Among 50 patients, 37 were diagnosed based on USG alone. 26 (52%) patients underwent evaluation by both USG and CT scan for inconclusive ultrasound or additional information for further patient management.

Ultrasound changed the clinical diagnosis in 12 cases, identified the cause for acute abdomen in 9 clinically inconclusive cases and confirmed the clinical diagnosis in 16 cases. However, ultrasound was inconclusive in 10 patients. CT scan changed the clinical diagnosis in 4 cases, diagnosed the cause for acute abdominal pain in 1 clinically inconclusive case and confirmed the clinical diagnosis in 7 cases. However, it was inconclusive in 1 case.

Table 3 - Role of USG and CT in Evaluation of Acute Abdomen (non-traumatic)

	Change in clinical diagnosis	Confirmation of clinical diagnosis	Diagnosis in clinically inconclusive case	Inconclusive Imaging Investigation
USG	12 (24%)	16 (32%)	9 (18%)	13 (26%)
CT Scan	4 (8%)	7 (14%)	1 (2%)	1 (2%)
Total	16 (32%)	23 (46%)	10 (20%)	1 (2%)

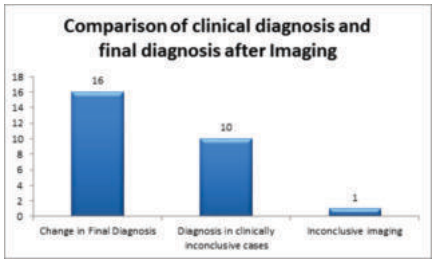


Figure 2: Showing comparison of clinical diagnosis and final diagnosis after Imaging

Table 4 - Role of CT in Evaluation of Acute Abdomen (non-traumatic)

	Change in USG diagnosis	Additional information to USG Diagnosis	Diagnosis in inconclusive USG	Inconclusive CT Scan
No. of Cases(26)	3	13	9	1
Percent (%)	6	26	18	2

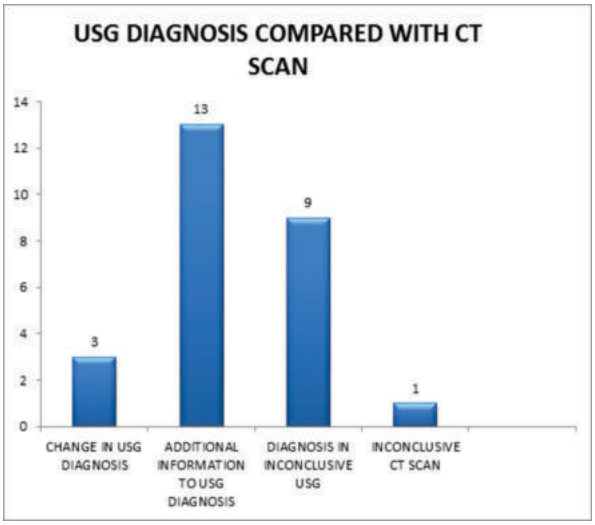


Figure 3: Showing USG diagnosis compared with CT Scan findings

CT scan was done in a total of 26 patients. In 13 patients diagnosed on ultrasound, CT scan was required for additional information for further patient management. In 3 out of 50 patients, CT scan was asked for by the treating doctor due to their strong clinical suspicion of alternate diagnosis. Diagnosis was changed after CT scan in these cases. In 10 out of 50 cases, USG was inconclusive and therefore, CT scan was done which correctly identified the cause for acute abdomen in 9 out of these 10 cases. However, CT Scan was inconclusive in 1 case of sealed off bowel perforation.

Table 5: Role of USG and CT scan in diagnosis of specific disease conditions causing acute abdomen

Disease Conditions	Concordance of USG findings with final Diagnosis	No. of cases missed on USG & diagnosed on CT	No. of cases that required CT for additional information
ACUTE APPENDICITIS	5	4	1
INTESTINAL OBSTRUCTION	8	2	6
ACUTE CHOLECYSTITIS	9	-	-
ACUTE PANCREATITIS	3	5	3
URETERIC COLIC	7	-	1
BOWEL PERFORATION	-	1	-
PYELONEPHRITIS	1	-	-
WORM INFESTATION	1	-	-
PELVIC INFLAMMATORY DISEASE	2	-	1
ANEURYSM	1	-	1
Total	37	12	13

In present study, among the 9 patients with acute appendicitis, 5 cases were diagnosed by USG and were in concordance with final diagnosis. Four cases were diagnosed on CT scan. CT Scan was required for confirmation and assessment of adjacent viscera in one case of appendicular lump.

There were 9 cases of acute calculous cholecystitis, correctly diagnosed on USG and underwent laparoscopic cholecystectomy.

Out of 10 cases diagnosed as intestinal obstruction on USG, the transition point and cause for obstruction was identified in 3 cases on USG, which were due to tubercular ileocaecal bowel wall thickening and intussusseption. Other 7 cases underwent CT Scan to identify the transition point and cause of bowel obstruction for surgical planning. Most common causes for intestinal obstruction in this study were tubercular ileocaecal wall thickening (2/9), intussusception (2/9), and mesenteric ischemia (2/9) followed by midgut volvulus (1/9), mesenteric bands (1/9), caecal mass (villous adenoma) (1/9) and gall stone ileus (1/9).

Out of 8 cases of acute pancreatitis, only 3 were identified on ultrasound, which required further imaging by CT Scan for severity scoring. 5 cases of pancreatitis were diagnosed on CT Scan.

Ultrasound diagnosed 7 cases of obstructive uropathy and identified the site of obstructive ureteric calculi in 6 cases. CT Scan was required in one case which showed mid ureteric calculus and dilatation of pelvicalyceal system proximal to it.

Other causes of acute abdomen in this study were bowel perforation (2/50), bilateral hydrosalpinx due to pelvic inflammatory disease (PID) (2/50) and right common iliac artery aneurysm (1/50). Additional CT scan was done in bowel perforation, aneurysm and and one case of PID.

Bowel perforation could not be diagnosed on ultrasound. CT Scan diagnosed one case of bowel perforation. However, it was inconclusive in one case as it was an old sealed off perforation.

Sensitivity of ultrasound in diagnosing cause for acute abdomen was 78.72% and that of CT scan was 96.15% with a significant difference (p value - 0.01).

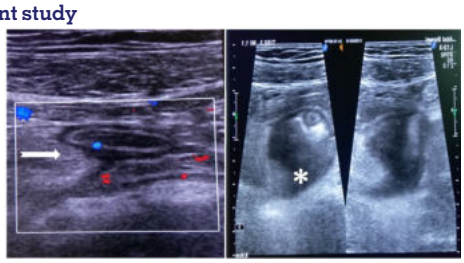
The ultrasound sensitivity in detecting acute appendicitis was 55.56% versus 100% for CT.

The sensitivity of ultrasound in detecting acute pancreatitis was 37.50% and that of CT was 100%.

The sensitivity of ultrasound in detecting intestinal obstruction was 80% and that of CT was 100%. However, ultrasound could detect the cause for intestinal obstruction in only 30% patients.

The sensitivity of ultrasound in detecting acute calculous cholecystitis and ureteric colic was 100% each.

Various radiological findings in the cases included in present study



A **B**

Figure 5: Showing ultrasound findings of a case of acute appendicitis. A) tubular blind-ended dilated structure (arrow) in right ilica fossa suggestive of acute appendicitis. B) mild loculated Interbowel fluid (*) and adjacent mesenteric inflammation is also noted.

Figure 6: USG abdomen showing appendicular lump in a patient with acute right iliac fossa pain

Figure 7: Soft tissue mass (arrow) measuring ~ 40 x 35 mm seen in right ileac fossa with adjacent streaking of mesentery and adjacent small bowl loop appear adherent with soft tissue mass. Appendix not visualised separately- suggestive of Appendicular lump formation.

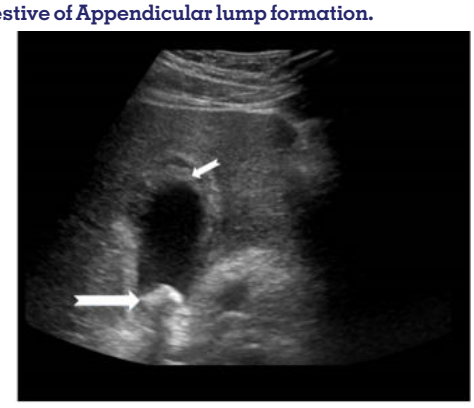
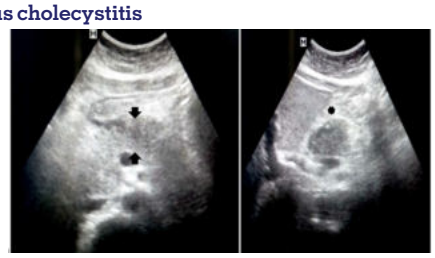


Figure 8: Showing Calculus (long arrow) at GB Neck with edematous and thickened GB walls (short arrow) – s/o acute calculous cholecystitis



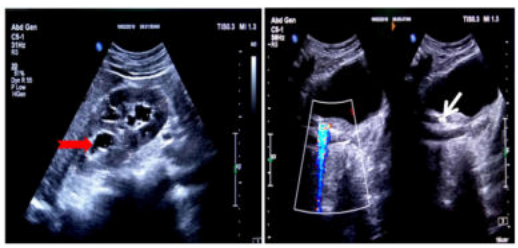
A B

Figure 9: USG abdomen showing A) enlarged pancreas with diminished echogenicity (arrows) and B) inflammatory ch anges in adjacent peripancreatic fat (star).

A

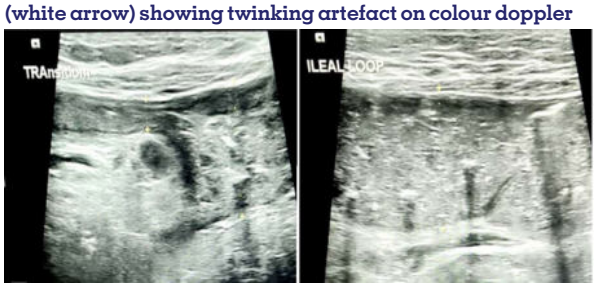
B C

Figure 10: Acute Pancreatitis CECT Abdomen showing A) Bulky pancreas (white arrows) with B) adjacent mesenteric fat stranding (asterisk) and lateral conal fascial thickening (red arrow) & C) bilateral pleural effusion (left > right) (star)



A B

Figure 11: USG of KUB region Showing A) mild right hydroureteronephrosis (black arrow) with B) VUJ calculus (white arrow) showing twinking artefact on colour doppler



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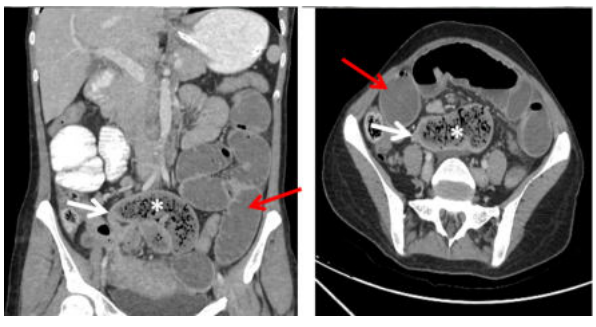


C D

Figure 12: (A) & (B) USG showing dilated small bowel loops with transition point at distal ileum with tubercular thickening of distal ileum. CT coronal (C) and axial (D) planes showing dilated small bowel loops (red arrows) with small bowel faeces sign (asterix) – s/o small bowel obstruction. Transition point is noted at distal ileum (white arrow).

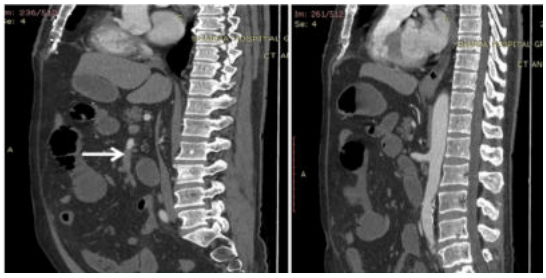
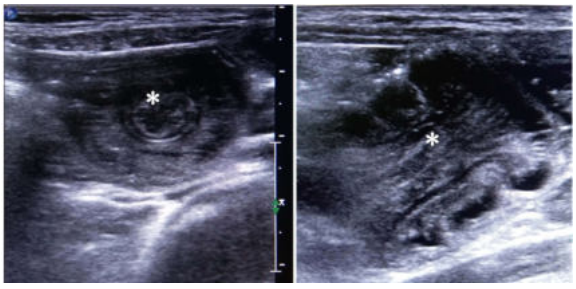


Figure 13: CT angiography of abdominal aorta in a patient with mesenteric ischemia. Superior Mesenteric Artery shows hypodense filling defect (arrow) just distal to its origin with no flow related enhancement suggestive of complete occlusion.



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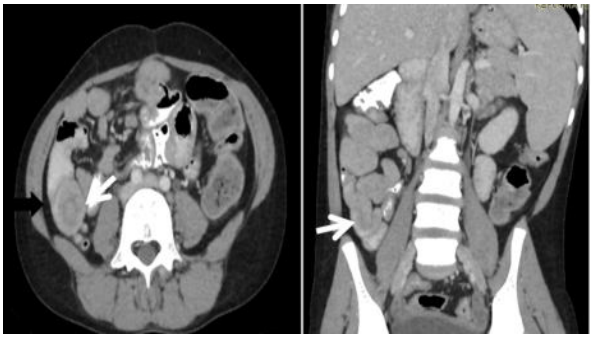
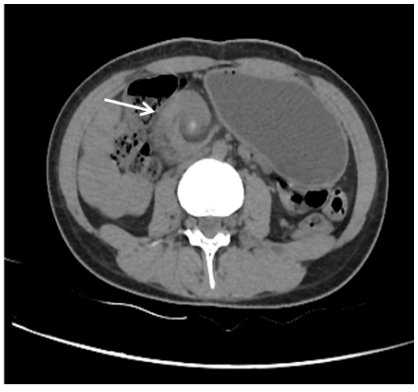


C D

Figure 14: Ilio-Ileal Intussusception. USG transaxial (A) and longitudinal (B) views showing bowel in bowel configuration with target appearance (asterix). CECT abdomen axial (C) and coronal (D) showing target appearance of ileoileal intussusception (black arrow) with proximal dilated bowel loops (white arrows).



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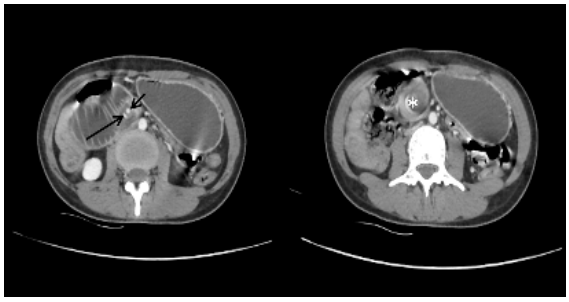


A B

Figure 15: CECT abdomen axial sections in a case of small bowel obstruction due to midgut volvulus showing (A) whirlpool sign (white arrow) due to swirling of mesentery with proximal bowel loop dilatation (asterix) (B) & (C) Showing the swirling of Inferior mesenteric vein (long arrow) around the superior mesenteric artery (short arrow) with proximal bowel loop dilatation (asterix)

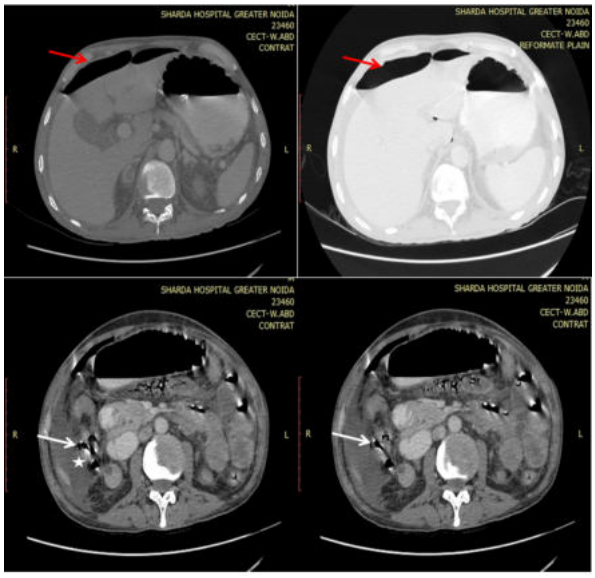
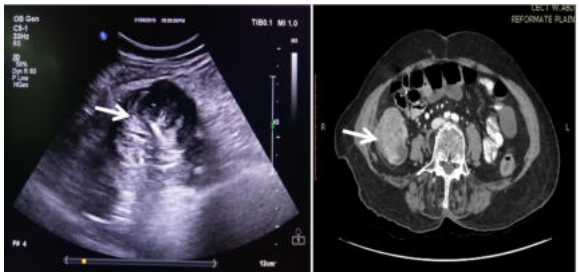


Figure 16: CECT abdomen showing pneumoperitoneum (red arrow), ascites (star) and site of perforation in second part of duodenum (white arrow)



A B

Figure 17: A) USG & B) CECT abdomen showing caecal mass (arrow)

Figure 18: A) USG showing Right Common Iliac artery

aneurysm with mural thrombus B) Colour Doppler showing characteristic yin-yang pattern

Figure 19: CECT whole abdomen of same patient as in figure 18 showing Right Common Iliac artery aneurysm (white arrow) with mural thrombus (asterix) & atherosclerotic wall calcifications (black arrow).

DISCUSSION

A common symptom presenting in the emergency room is acute abdominal pain. There is a spectrum of causes of acute abdomen; imaging plays a pivotal role in diagnosing the cause. Having a correct diagnosis is important in preparing the required management.

Our research aimed primarily at demonstrating the role of USG and CT in achieving a clear diagnosis in patients with non-traumatic acute abdomen. Ultrasound was initially done for these patients, and CT was conducted for patients in whom ultrasound was inconclusive or when additional information was requested by the clinician. Ultrasonography-related diagnosis and CT-related diagnosis were compared with the per-operative or final discharge diagnosis. Role of Ultrasound and CT in evaluation of non-traumatic acute abdomen were compared. In our study, when finalizing the diagnosis, the overall sensitivity of US was 74% and that of CT was 96.15% with insignificant difference (p value – 0.018).

The present study included 50 patients attending the emergency department with history of acute abdominal pain for less than 3 days duration. Among them 35 were males and 15 were female patients. The mean age of the patients was found to be 39.38yrs similar to other studies.[7,8]

The most common disease conditions causing acute abdomen in our study were found to be intestinal obstruction (10/50) followed by acute calculous cholecystitis (9/50) and acute appendicitis (9/50), followed by acute pancreatitis (8/50) and ureteric colic (7/50). Other causes for acute abdomen included bowel perforation, pelvic inflammatory disease and aneurysm. This was in concordance with a study done by van Randen A et.al. Similar pattern of causes for the non-traumatic acute abdominal pain was seen in patients in various studies.[9]

Ultrasound diagnosis matched with final diagnosis in 37 patients with acute abdomen; hence the sensitivity of USG in diagnosing cause for acute abdomen was 78.72%. These findings matched with previous study done by Dr Rupinder Singh, Dr Harsimar, Dr Harneet Narula et al concluded that USG diagnosis was consistent with final diagnosis in 70%.[3]

CT scan was required in 26 patients (52%). CT scan correctly diagnosed the disease condition in 25 out of 26 cases of acute abdomen which underwent CT scan. Sensitivity of CT was 96.15%. Andrew B. Mac Kersie, Michael J. Lane et al performed a study on 91 patients and concluded that CT scan yielded an overall sensitivity, of 96.0% in diagnosing the cause for acute abdomen.[10]

Ultrasound was inconclusive in 10 patients with acute abdominal pain and ultrasound diagnosis did not match final diagnosis in 3 cases. These included 4 cases of acute appendicitis, 5 cases of pancreatitis and 1 case of bowel perforation. Ultrasound diagnosis did not match the final diagnosis in a case of appendicitis which was diagnosed as mesenteric lymphadenopathy on USG, one case of pancreatitis and a case of gall stone ileus, both of which were given the diagnosis of cholelithiasis on ultrasound. These cases were diagnosed correctly on CT scan.

In 13 cases of acute abdomen, although ultrasound diagnosed the disease condition correctly, CT scan was required for additional information to proceed with the adequate clinical management of the patient. These included 5 cases of intestinal obstruction, 3 cases of pancreatitis, 1 case each of acute appendicitis, ureteric colic, ileocaecal bowel wall thickening, bilateral hydrosalpinx in PID and common iliac artery aneurysm.

In our series the ultrasound sensitivity in detecting acute appendicitis was 55.56% versus 100% for CT. Out of 9 patients with the acute appendicitis including appendicular lump, 5 cases were diagnosed on USG. 4 cases showed tubular, blind ending, aperistaltic, non - compressible appendix greater than 6mm in diameter with probe tenderness in the right iliac fossa. Mild free fluid and mesenteric lymph nodes with inflamed echogenic mesenteric fat were also noted adjacent to the appendix. Appendicoliths was visualised in one case as intraluminal hyperechoic foci with distal acoustic shadowing. These findings on USG were similar to study done by Tomizawa M, Shinozaki F, Hasegawa R in 2017.[11]

One case of appendicular abscess was diagnosed on ultrasound which showed a hypoechoic mass adjacent to an inflamed appendix with surrounding inflamed mesenteric fat. CT Scan was required in this case for confirmation and assessment of adjacent viscera.

3 cases of acute appendicitis could not be diagnosed on ultrasound due to excessive bowel gas shadows and retrocaecal location of appendix. Another case of appendicitis could not be evaluated on ultrasound due to guarding and bowel gas shadows.

CT scan was done in these 4 cases which identified the dilated fluid filled appendix with thick enhancing walls. In study by Debnath J et al, it was suggested USG's effectiveness in diagnosing appendicitis is operator dependant. CT scanning has been found to be more effective for this reason than USG, and is commonly supported and used.[12]

The sensitivity of ultrasound in detecting acute pancreatitis was 37.50% and that of CT was 100%. Out of 8 cases of acute pancreatitis, USG was able to diagnose 3 cases. The ultrasound features of acute pancreatitis were enlarged hypoechoic pancreas due to edema with indistinct boundaries and peripancreatic free fluid. These findings correlate well with study done by Tomizawa M, Shinozaki F, Hasegawa R in 2017.[11] However, all 8 cases underwent CT scan for confirmatory diagnosis and severity scoring for further management. On CT pancreas appeared enlarged with low or heterogeneous attenuation of gland with shaggy

contour.[13] There were 4 cases of interstitial pancreatitis where the pancreatic gland was enlarged and showed normal enhancement with no pancreatic parenchyma necrosis. Other 3 cases were of Necrotizing pancreatitis. Pancreas was enlarged with non-enhancing areas suggestive of necrosis. These findings on CT were similar to those described in previous studies done by Balthazar EJ in 2002 [13] and Petroianu A, Alberti LR, Zac RI. et al in 2005. [14]

5 cases of pancreatitis diagnosed on CT scan were missed on ultrasound due to poor visualisation of pancreas because of excessive bowel gas shadows in epigastric region. The value of epigastric ultrasonography in acute pancreatitis is not much, as an assessment of the pancreatic parenchyma is often limited by the over-inflation of the transverse colon and the ascending colon. In study by Hessel SJ et.al., it was concluded that a negative ultrasound does not exclude pancreatic disease.[15]

The sensitivity of ultrasound in detecting intestinal obstruction was 80% and that of CT was 100%. However, ultrasound could detect the cause for intestinal obstruction in only 30% patients. Further imaging by CT scan was required for localizing the transition point, establishing the cause for intestinal obstruction and pre-surgical planning. CT scan correctly identified the transition point and the cause for obstruction in all 7 cases which underwent CT.

Presence of abundant gas in the intestinal lumen is characteristic in most patients with obstruction, frequently producing sonograms of non-diagnostic quality. CT proved to be an efficient and correct imaging modality in determining the presence, level and etiology of obstruction when compared to USG in this study. Similar results were obtained in a study done by Suri S et al with sensitivity of USG in diagnosing intestinal obstruction as 83% and sensitivity of CT for the existence of obstruction as 93%. The percentage of determining the cause for obstruction for CT ad USG were 87% and 23% respectively.[16] Likewise Similar conclusions were made in study by Debnath J et al and Durgesh Kumar Saini et al.[12,17]

There were 2 cases of bowel perforation, both of which were not diagnosed on ultrasound. X-ray erect abdomen was done in 1 case which showed air under diaphragm, suggestive of pneumoperitoneum. Ultrasonography showed free fluid in the peritoneal cavity, few distended loops of intestinal coils. All these findings were nonspecific. CT scan revealed pneumoperitoneum due to perforation. The site of perforation was correctly identified on CT at the second part of duodenum, as confirmed by intra-operative findings. Stapakis JC et al[18] demonstrated that CT to be more beneficial than plain radiograph. Furukawa A et al[19] stated that CT can evaluate even very minute presence of extra luminal air in addition to ascitis.

There was one case of sealed off perforation in which USG and CT scan could not identify the site of perforation. On operative findings a rent was found in fundal region. CT could not detect this case because of the small size of perforation which was old and sealed off. Our result was similar to study carried out by J Sherck et al [20] and Maniatis V et al [21] who stated that it is not necessary that when free air is not present then it is not perforation.

There were 7 cases of ureteric colic, which were diagnosed on USG which showed hydronephrosis or hydroureteronephrosis depending upon the site of obstruction. These cases were due to obstructive uropathy caused by ureteric calculi. The sensitivity of USG in identifying the cause and site of ureteric obstruction was 85.71%. USG could not identify the cause and site of left hydroureteronephrosis in one case due to excessive bowel gas shadows. CT scan showed an obstructive calculus in left mid ureter.

All the cases of acute calculus cholecystitis were diagnosed by USG alone with 100% accuracy rate. USG revealed positive "sonographic Murphy's sign", i.e., probe tenderness over sonographically localized gall bladder with thickened edematous GB wall and mild pericholecystic free fluid. 4 out of 10 cases showed multiple stones while 6 cases revealed single large calculus at the GB neck. Calculi are seen as hyperechoic structure with distal acoustic shadows on USG. These findings correlate well with study done by Tomizawa M, Shinozaki F, Hasegawa R in 2017. [11]

Other causes of acute abdomen were pelvic inflammatory disease (PID), pyelonephritis, cystitis and right common iliac artery aneurysm, which were seen on USG. However, CT scan was required for additional information in case of aneurysm such as perianeurysmal leak, extent and mass effect. CT scan was also done in case of PID for confirmation and extent of disease.

USG is known to be highly operator dependent in comparison to CT scan.

Besides the fact that USG has no ionizing radiation and hence can be repeated without any significant adverse effects, which is very important particularly in children and young women; it also provides several clinically relevant and important information. Moreover, it is a more cost-effective investigation. CT scan has the disadvantage of higher cost and the radiation exposure. We observed the overall sensitivity of US was 74% and that of CT was 96.15% with insignificant difference (p value – 0.018), especially in majority of the conditions causing acute abdominal pain namely acute cholecystitis, acute appendicitis, intestinal obstruction, pancreatitis and ureteric calculi. Therefore, US should be the primary imaging modality in all patients of acute abdomen. CT should be reserved only for the minority of clinical situations such as in patients with retro-caecal appendicitis, bowel obstruction cases for defining the transition point and in patients with pancreatitis to obtain the CT Severity index.

CONCLUSION

We propose that US should remain the primary imaging modality in all patients of acute abdomen in order to prevent radiation exposure, especially as it was found to have a sensitivity comparable to CT, in majority of the clinical situations. Moreover, it is a more cost-effective investigation. Therefore, CT should be reserved only for the minority of clinical situations where US is significantly inconclusive or additional information regarding the diagnosis made on ultrasound is needed for further patient management.

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