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MDCT Evaluation of Non-Traumatic Acute Abdomen

Dr.P.P.Balamurugan [1], Dr.Murali Nanjundan [2], Dr.S.Kanagadurga [3], Dr.S.Thaiyalnayagi [4]

[1,2,3,4] *(Department of Radiodiagnosis, Govt. Coimbatore Medical College Hospital, Tamilnadu, India)*

Abstract:
Objective: *To evaluate the accuracy and impact of early computerized tomography (CT) in the diagnosis of non -traumatic acute abdomen when Ultrasonogram (USG) or X-ray findings are negative, equivocal or unable to provide additional information regarding the diagnosis.*
Materials and methods: *126 patients were included in this prospective study. Ultrasonogram was done as the initial modality in these patients and CT was done when USG findings were negative, equivocal or unable to provide additional information. Axial, coronal and sagittal reformatted images were studied. When appropriate, MIP and volume rendering techniques were also analysed. IV, oral and rectal contrast were used depending upon the clinical condition. All the 126 patients were followed up and diagnoses obtained before and after CT were compared with per-operative findings or final diagnosis at discharge.*
Results: *Among 126 patients, correct diagnosis could be obtained in 125 patients. The initial planned management was changed in 18 patients; 13 patients who were initially planned for surgery were managed, conservatively and 5 patients who were initially placed on conservative management were operated upon. Thus unnecessary surgery was avoided in 13 patients and much needed emergency surgery performed on 5 patients based on CT findings.*
Conclusion : *Early CT abdomen done in patients presenting with non –traumatic acute abdominal pain helps in arriving at an accurate diagnosis and planning the appropriate treatment, thus reducing the morbidity and mortality.*

Keywords: *Acute Abdomen, Multi-detector CT*

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I. Introduction

Acute abdominal pain is one among the common causes of admission in emergency department. The spectrum of causes of acute abdominal pain range from benign self limiting conditions to life threatening disorders. Hence, a timely and accurate diagnosis is needed to intervene at the appropriate time to reduce the morbidity and mortality. The clinical manifestations of the several causes of acute abdominal pain can often be vague and a straight forward clinical diagnosis may not be possible. Hence, imaging plays a vital role in the diagnostic work up and helps to triage these patients. Abdominal radiography is widely available and especially useful in patients with small bowel obstruction and pneumoperitoneum.[1,2]. In majority of the cases, a definitive diagnosis cannot be made with radiography alone and further imaging is required. Ultrasonogram (USG) is another widely used imaging modality in patients with acute onset of abdominal pain. USG provides additional information, as it helps in real time visualization of the abdominal organs, bowel caliber, bowel wall thickness, peristalsis and the blood flow can also be assessed with the use of Doppler[3]. But, USG can often be inconclusive especially in the presence of extensive bowel gas and intra -abdominal fat.

CT has emerged as the most appropriate imaging modality in arriving at a specific diagnosis, especially when ultrasonography is inconclusive. CT has achieved this vital role as it permits global visualization of the gut, mesentery, omentum, peritoneum, retroperitoneum, vasculature, solid organs, abdominal musculature and bones[4,5,6]. The purpose of the study is to evaluate the accuracy of CT in diagnosis of acute abdomen, to determine the impact of early CT diagnosis on clinical decision making regarding management, besides enumerating the spectrum of causes of non – traumatic acute abdomen. Based on this our objectives were to evaluate the accuracy of CT in the diagnosis of non traumatic acute abdomen in cases where USG and X-Ray findings are negative / non - specific or are unable to provide additional information relating to the diagnosis. Also to evaluate the impact of CT in early diagnosis on the management of non-traumatic acute abdomen. Additionally we also wanted to enumerate the spectrum of causes of non-traumatic acute abdomen.

II. Materials And Methods

TOSHIBA Multi-slice CT (4 slice) was used for all the cases. Serial axial section of abdomen and pelvis were taken from diaphragm to inferior border of symphysis pubis with a collimation of 5 – 7 mm and pitch of 1 to 1.5 depending on the length of coverage. Multi-planar reconstruction was done at intervals of 3-7 mm. Axial and coronal/sagittal reformatted images were studied. When appropriate, maximum intensity projection, minimum intensity projection and volume rendering techniques were also analysed. Initially plain CT abdomen and pelvis axial sections were taken, followed by contrast study. Iodinated I V contrast was routinely used except in patients suffering from medical renal disease and known anaphylaxis to medications. e - GFR was calculated and contrast was administrated only when e GFR was normal. Oral and rectal contrast was used wherever necessary. The I V Contrast used was IOHEXOL (Omnipaque) 350 mg iodine/ml at a dose of 1.75 ml /kg (Avg -90 to 100 ml) by using power injector through IV cannula (18 Gauge) at a rate of 2ml /sec.

This was a prospective study of consecutive patients with acute abdomen in the study period from July 2015 to August 2016. The study was commenced after approval from the ethical committee. Formal consent for the study was obtained from all the patients. Patients with history of acute abdominal pain, abdominal distension, abdominal guarding and rigidity were included. Also in few patients where diagnosis was already made by ultrasonogram but CT was requested by referring clinician for additional information were also included in the study. Similarly patients with history of trauma (blunt injury and penetrating injury), pregnant mothers, patients for whom a confirmed diagnosis was made by ultrasonogram were excluded from study

III. Results

The present prospective study was done on 126 patients who presented to the emergency department with acute abdominal pain. 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. Majority of the patients, that is 111patients were referred from the surgical and surgical allied emergency departments and 15 patients were referred from the emergency medicine ward. Among the 126 patients, 30 patients belonged to age group less than 30 years, 75 patients belonged to 30-60 years age group and 21 patients belonged to age more than 60 years. Among 126 patients in our study, majority of the patients were males.93 (74%) patients were male and 33 (26%) patients were female.

CT abdomen and pelvis was done in 126 patients and the various diagnosis obtained were tabulated and grouped into organ specific diagnosis. In our study, diseases pertaining to bowel scored the highest followed by kidney and ureter and the pancreas followed by other abdominal organs.

Table 1: Organ specific finding:

	Organ specific finding
Abdominal wall	1
Gall bladder	1
Ovary	1
Spleen	2
Retroperitonium	3
Liver	9
Vascular	10
Pancreas	13
Kidney, Ureter, Urinary bladder	19
Bowel	67

Among the 67 patients with disorders of the gastrointestinal tract, acute appendicitis was the most frequently encountered. Acute appendicitis was the most commonly observed surgical emergency in our study, which was observed in 17 patients. Perforative peritonitis constituted the next most commonly observed pathology in this group of patients.

The ultra-sonographic features of the 126 patients were compared with the findings obtained in computed tomography. Compared to USG, CT was better in achieving a specific diagnosis. CT could pick up 8 cases of appendicitis which were not picked up in USG. Similarly, CT could pick 3 cases of bowel perforation, 10 cases of small bowel obstruction, 3 cases of bowel ischemia, 1 case of aortic aneurysm, 10 cases of intra-abdominal abscess, 7 cases of pyelonephritis, 5 cases of renal and ureteric calculi, 5 cases of volvulus and 8

cases of acute pancreatitis which were not clearly depicted in USG and CT helped in providing the appropriate treatment.

Table-2: Additional cases diagnosed by CT:

	With USG	After CT	Difference
Abscess (All)	16	19	+3
Aortic aneurysm	3	4	+1
Appendicits	9	17	+8
Bowel perforation	10	13	+3
Cholecystitis	1	1	0
Small bowel ischemia	0	3	+3
Intestinal obstruction	6	6	0
Renal calculus	1	5	+4
Pyelonephritis	5	9	+4
Acute pancreatitis	4	12	+8
Volvulus	2	5	+3

On follow up of these patients, 93 patients were operated and 33 patients were managed conservatively. In 13 patients, surgery was planned before performance of CT. After CT was performed, there was a change in diagnosis and these patients were put on conservative treatment. In five patients who were planned to be managed conservatively, after CT was performed there was a change in the final diagnosis and surgery was performed.

IV. Discussion

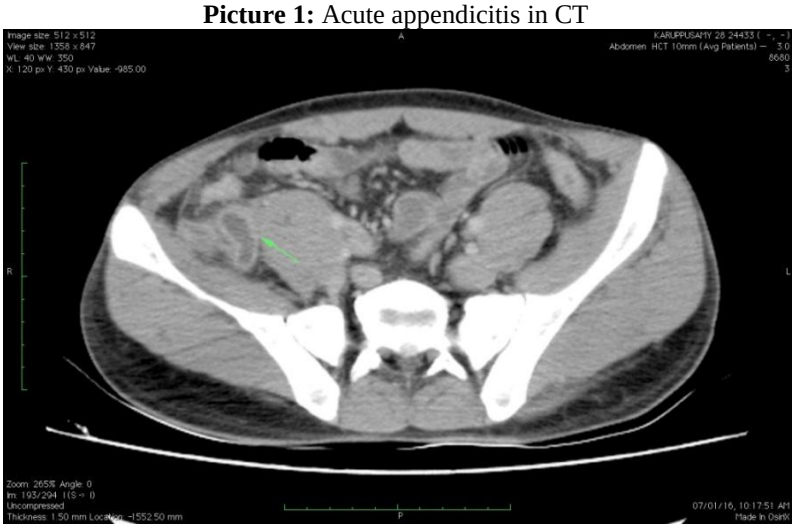
The main aim of our study was to illustrate the importance of CT in obtaining a specific diagnosis in patients with non-traumatic acute abdomen. Initially ultrasound was performed for these patients and CT was performed when ultrasound was inconclusive or when the clinician wanted additional information. The diagnosis obtained by ultrasonography and that obtained by CT were compared with the per -operative or final diagnosis at discharge. In our study, CT was found to be better than ultrasonography in finalizing the diagnosis. Similarly the impact of CT on the management of these patients was assessed.

In a study conducted by Rosen et al on [7] patients presenting with non traumatic acute abdomen it was stated that abdominal CT could change the planned treatment in 33 patients. The planned treatment based upon the clinical diagnosis was hospital based management in 42 patients. But after performing CT, a total of 32 patients were only admitted, thus CT could avert 10 among these 42 admissions. In this study after performing CT, 2 patients who were initially planned to be sent home were admitted. Additionally 6 patients who were planned on conservative treatment, underwent immediate surgery after performing CT.

Our study correlated with the study done by Rosen et al[7] in proving that CT could provide the appropriate management for these patients. In our study the management was changed in 18 patients. 13 patients who were planned for immediate surgery, after performing CT, the management of these patients was changed to conservative treatment. Similiarly 5 patients who were planned to be kept on observation, after performing CT were operated immediately.

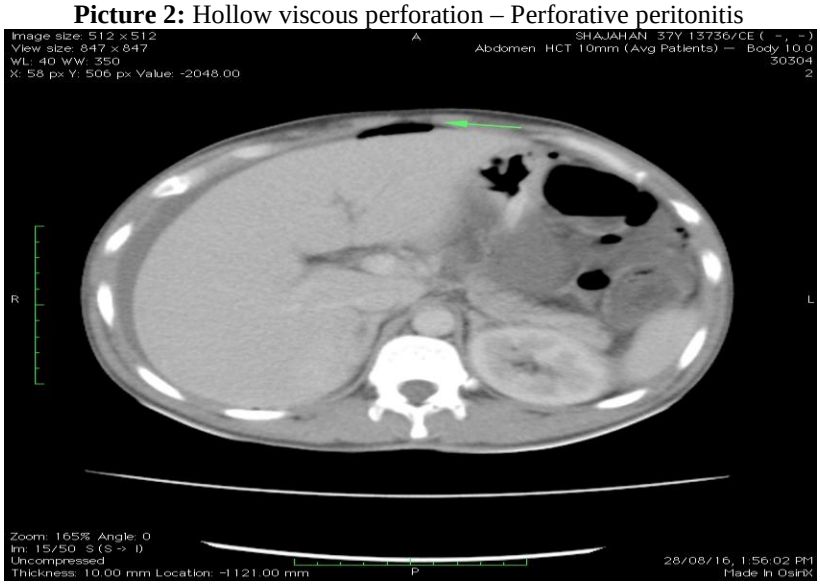
In our study the diagnosis obtained through ultrasound and CT were compared. CT scored over ultrasound in diagnosing and detecting the complications of several conditions such as acute appendicitis, hollow viscus perforation, volvulus, pancreatitis, pyelonephritis, uretertic stones and abdominal vascular pathology. Among the total of 17 cases of acute appendicitis, ultrasound could diagnose only 9 cases but CT could diagnose additional 8 cases, which were not suspected in ultrasonography. Appendix when especially retro-caecal in position is difficult to visualize, because of the caecal gas shadows. These cases could be diagnosed by the help of CT. Early cases of acute appendicitis which were minimally distended and measuring about 5-6 mm diameter could be picked up by CT. The complications such as perforated appendix, appendicular abscess, intra peritoneal abscess were better detected through CT[8].

Picture 1: Acute appendicitis in CT



A total of 13 cases of hollow viscus perforation were diagnosed. 10 cases were diagnosed in ultrasonography. Additional of three cases of hollow viscus perforation could be detected by CT. Tiny pockets of free intra-peritoneal air may go undetected in ultrasonography, but CT could readily detect the same.

Picture 2: Hollow viscous perforation – Perforative peritonitis



CT detected 7 cases of volvulus of which only 2 cases were diagnosed by ultrasonography. The 2 cases of volvulus that were diagnosed in ultrasonography were mesenteric and mid gut volvulus. The other 5 cases of volvulus which could not be diagnosed in ultrasonography were cases of sigmoid volvulus. It was due to the extensively dilated gas filled large bowel loops preventing the penetration of ultrasound beam. In abdominal radiography in these 5 cases there was a strong suspicion of sigmoid volvulus. Thus CT proved to be a better imaging modality for confirming a diagnosis of volvulus[9].

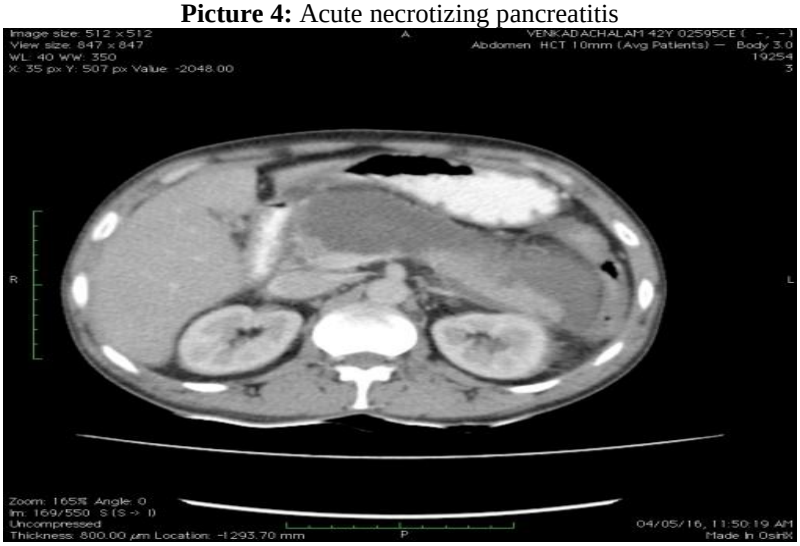
Picture 3: Midgut volvulus in CT

Three cases of bowel ischemia which were not diagnosed by ultrasound were detected in CT. In one of these, pneumatosis was picked up in the ileal loops and in the other two cases bowel wall thickening and intramural hemorrhage was identified in CT which could not be made out in ultrasonography.

Only one case of emphysematous cholecystitis was referred for CT. The main reason is higher sensitivity of ultrasonography in diagnosing the disorders of gall bladder and biliary system. Hence, CT was not essential for further evaluation.

A total of 12 cases of pancreatitis were included in our study. Ultrasound had missed 8 cases and it could diagnose only 4 cases. CT is superior in diagnosing acute pancreatitis and its complications. In ultrasonography, it is difficult to diagnose pancreatitis because of bowel gas and obesity[10]. But, CT could overcome these limitations of ultrasonography. The complications of pancreatitis could be better detected in CT. The presence of pancreatic and peri- pancreatic fluid collections, pancreatic necrosis, pancreatic abscess, pseudo-cyst and vascular complications could be better appreciated in CT[11]. The CT severity index could be determined which helped in predicting the prognosis. The presence of peri-pancreatic fat stranding, loss of normal lobular contour of the pancreatic borders helped to diagnose early cases of acute interstitial pancreatitis which could not be made out in ultrasound[12]. In our study, there was a case of pseudo-cyst of pancreas with cysto- gastric fistula. Ultrasound showed only the presence of pseudo-cyst in pancreas, but CT performed after administration of oral and IV contrast revealed the presence of fistulous communication between the cyst and stomach, thus proving that CT was superior in diagnosing and detecting the complications of acute pancreatitis.

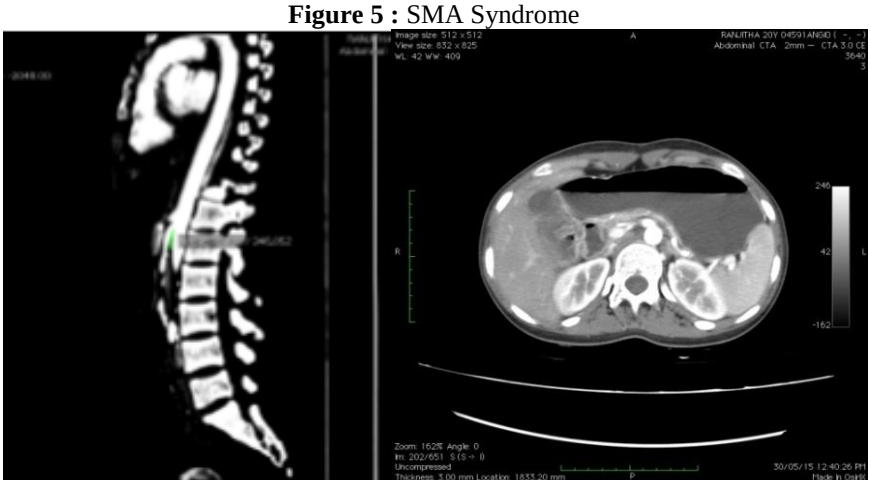
Picture 4: Acute necrotizing pancreatitis



Ureteric calculi were better detected in CT compared to ultrasound. In these cases, ultrasound only showed the presence of hydro-uretero-nephrosis because the mid and distal ureter tracing was poor due to the presence of bowel gas shadows[13]. CT could detect the exact location, size of calculus and the severity of obstruction caused by it. CT is superior to USG to detect pyelonephritis, emphysematous pyelonephritis and their complications.

Vascular pathologies like SMA thrombus, SMV thrombus, SMA syndrome, renal artery thrombosis, aortic aneurysm and aortic dissection and their complications were better detected in CT[14]. In one patient USG made the diagnosis was grossly dilated stomach and duodenum. After CECT was performed it was seen that the AMA angle was severely reduced causing compression on third part of duodenum with no evidence of mass lesion. Thus the diagnosis of SMA syndrome was made in CT.

Figure 5 : SMA Syndrome



In the study conducted by Rosen et al[7], among the 57 patients, complete follow up could be done for 44 patients. CT could yield correct diagnosis in 41 patients. False positive diagnosis was made in 2 patients, in one patient CT showed thickening of transverse and descending colon but colonoscopy showed the presence of only lymphoid aggregates. In another case inflammatory changes were seen around the appendix and the case was diagnosed to as acute appendicitis but per - operative finding revealed normal appendix. One false negative diagnosis was made in a patient with right lower quadrant pain. CT revealed a normally looking appendix but per operatively appendix was inflamed, suggestive of appendicitis.

Similarly, the 126 cases in our study were followed up. The correct diagnosis was obtained in 125 cases. In our study, CT provided a false positive diagnosis in one patient. CT showed the presence of diverticuli with probable presence of rent in the diverticulum in the region of hepatic flexure. But per operatively, the colon appeared normal.

Figure 6: Gastro-jejunal intussuception

In our study, it was proved that CT could provide timely and correct diagnosis in 125 patients among the 126 cases. In a few patients there was dis-cordance in the clinical diagnosis and CT diagnosis. On follow up of these patients, the diagnosis made in CT was found to be correct and the previously planned management was

changed. For example, in one case there was clinical suspicion of right ureteric colic when CECT was done, it showed presence of inflamed appendix apart from the right ureteric calculus. The patient was operated and the per-operative finding revealed inflamed appendix. Another case referred as left ureteric colic was diagnosed as epiploic appendagitis in CT and the patient was treated conservatively.

The disadvantage of CT is the cost and the radiation exposure. But CT provides a timely diagnosis and reduces the hospital stay and morbidity. Hence early and timely use of CT proved to be cost effective and decreases patient morbidity.

V. Conclusion

Acute abdominal pain is a common presenting symptom in the emergency department. Pain being a subjective symptom and the spectrum of causes of acute abdominal pain being broad, imaging plays a pivotal role in diagnosing the cause of acute abdominal pain. Making an appropriate diagnosis is essential in planning the appropriate management and reducing morbidity and mortality.

Though radiography is widely available, its use is limited mainly for hollow-viscus perforation and intestinal obstruction. USG can be inconclusive in the presence of extensive bowel gas or abdominal fat which would prevent adequate visualization of abdominal organs.

In our study it has been proved that CT helps in arriving at an accurate diagnosis. The associated complications of the underlying disease can also be determined with CT which helps in predicting the prognosis. CT can effectively guide the clinician regarding the management. It helps to determine who need surgery and who do not. Hence CT can be considered as the primary imaging with the exception of acute cholecystitis in which USG proved highly sensitive in the diagnosis.

Despite the small risk of radiation and the slightly increased cost, prompt utilization of CT in investigating cases of acute abdomen gives more accurate diagnosis and leads to better decision making regarding management, thus improving outcomes.

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