

The Study of Role of CT in Evaluation of Non-traumatic Acute Abdomen**Keerthi Bharathi P¹, Deepthi Tippani²**¹Assistant Professor, Department of Radiology, Prathima Relief Institute of Medical Sciences, Mulugu Road, Hanamkonda, Telangana State²Professor, Department of Radiology, Prathima Relief Institute of Medical Sciences, Mulugu Road, Hanamkonda, Telangana State.

Received: 13-06-2023 / Revised: 20-07-2023 / Accepted: 01-08-2023

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Conflict of interest: Nil

Abstract:

Background: The term 'Acute Abdomen' denotes a medical condition marked by intense abdominal pain that emerges within a few hours. In determining the underlying cause of this condition, CT scans have proven to be more effective than clinical evaluation, basic laboratory tests, and inconclusive imaging examinations, regardless of the duration of signs and symptoms. This study aims to determine the significance of CT scans in diagnosing the origins of acute abdominal pain.

Methods: A Toshiba Multi-slice CT scanner with 4 slices was utilized for all cases. Abdominal and pelvic images were captured in serial axial sections from the diaphragm to the lower border of the symphysis pubis. The collimation was set at 5 – 7 mm, and the pitch ranged from 1 to 1.5, depending on the required coverage length. Multi-planar reconstruction was conducted at intervals of 3-7 mm. The images were studied in both axial and coronal/sagittal reformatted views.

Results: In this study, out of n=40 cases of non-traumatic acute abdomen existence of urinary pathologies followed by hepatobiliary pathologies. GI pathologies were in 25% of cases and pancreatic pathologies were in 12.5% of cases. Renal calculi were the cause of non-traumatic acute abdomen in 42.58% of cases followed by ureteric calculus in 35.71% and vesical calculus in 21.43% of cases.

Conclusion: Proper diagnosis of acute abdomen is essential for effective management and reducing complications and mortality. While radiography is available, its use is mostly limited to cases of hollow-viscus perforation and intestinal obstruction. Ultrasound (USG) may be inconclusive in the presence of excessive bowel gas or abdominal fat, hindering the visualization of abdominal organs. Despite the slight increase in cost and the small risk of radiation, the prompt use of CT in investigating acute abdomen cases results in more accurate diagnoses and improves decision-making, ultimately leading to better patient outcomes.

Keywords: Acute abdomen, Appendicitis, Cholecystitis, CT scan, Pancreatitis.

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Introduction

Acute abdominal pain is a prevalent reason for admissions to the emergency department. The causes of this condition encompass a wide range, from benign and self-limiting to life-threatening disorders. As a result, it becomes crucial to promptly and accurately diagnose the underlying issue to intervene at the right time and minimize morbidity and mortality. The clinical manifestations of various causes of acute abdominal pain can be ambiguous, making a straightforward clinical diagnosis challenging. Therefore, medical imaging plays a vital role in the diagnostic process and aids in prioritizing patient care. Abdominal radiography is readily available and particularly valuable for detecting conditions like small bowel obstruction and pneumoperitoneum. [1, 2] However, in most cases, a definitive diagnosis cannot be achieved solely through radiography, necessitating further

imaging. Ultrasonography (USG) is another commonly used imaging technique for patients with sudden-onset abdominal pain. USG provides real-time visualization of abdominal organs, bowel caliber, bowel wall thickness, and peristalsis, and can even assess blood flow using Doppler. [3] of Nevertheless, USG may sometimes yield inconclusive results, especially when extensive bowel gas or intra-abdominal fat is present."

CT has emerged as the most suitable imaging technique for establishing a specific diagnosis, particularly when ultrasonography fails to provide conclusive results. Its capacity to provide a comprehensive view of the gut, mesentery, omentum, peritoneum, retroperitoneum, vasculature, solid organs, abdominal musculature, and bones has granted it a critical role in diagnosis. [4-6] The primary aim of this study is to assess the

accuracy of CT in diagnosing acute abdomen and to examine how early CT diagnosis impacts clinical decision-making regarding patient management. Furthermore, the study aims to identify the range of causes of non-traumatic acute abdomen, specifically focusing on cases where ultrasound (USG) and X-ray findings are negative, non-specific, or fail to offer additional diagnostic information. Additionally, the study seeks to evaluate the influence of CT in facilitating early diagnosis and subsequent management of non-traumatic acute abdomen. Lastly, the research aims to provide an enumeration of the various causes contributing to non-traumatic acute abdomen.

Material and Methods

This cross-sectional study was conducted in the Department of Radiology, Department of Radiology, Prathima Relief Institute of Medical Sciences, Mulugu Road, Hanamkonda, Telangana State. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study. The sample selection was done by the convenience sampling method. Consecutive cases of suspected appendicitis were included in the study based on the inclusion and exclusion criteria

Inclusion criteria

1. Suspected cases of acute abdomen of non-traumatic origin.
2. Males and females
3. Aged 10 years and above
4. Willing to participate in the study voluntarily

Exclusion criteria

1. Traumatic acute abdomen
2. Recurrent acute abdomen post-surgery
3. Pregnant females
4. Not willing to participate in the study.

The study included consecutive patients who experienced acute abdomen. The inclusion criteria encompassed patients with a history of acute abdominal pain, abdominal distension, abdominal

guarding, and rigidity. Furthermore, some patients who had already received a diagnosis through ultrasonography but were referred for CT scans to gather additional information were also included. Conversely, the study excluded patients with a history of traumatic injuries (both blunt and penetrating), pregnant individuals, and those for whom a confirmed diagnosis had been established through ultrasonography.

A Toshiba Multi-slice CT scanner with 4 slices was utilized for all cases. Abdominal and pelvic images were captured in serial axial sections from the diaphragm to the lower border of the symphysis pubis. The collimation was set at 5 – 7 mm, and the pitch ranged from 1 to 1.5, depending on the required coverage length. Multi-planar reconstruction was conducted at intervals of 3-7 mm. The images were studied in both axial and coronal/sagittal reformatted views. Additionally, for appropriate cases, further analysis involved maximum intensity projection, minimum intensity projection, and volume rendering techniques. The imaging procedure began with plain CT scans of the abdomen and pelvis in axial sections, followed by a contrast study.

Statistical analysis: All the available data was uploaded in MS Excel Spreadsheet and analyzed by SPSS version 19 in Windows format. The continuous variables were represented as mean, standard deviations, percentages, and categorical variables were calculated with the chi-square test, and p values of < 0.05 was considered significant.

Results

In this study, a total of 40 cases of suspected acute abdomen were included in the study out of which 30(75%) of cases were males and 10(25%) of cases were females. The male-to-female ratio was 3:1. Most of the cases in the study were from the age group 21 – 30 years (25%) followed by the age group 41 – 50 years and 61 – 70 years with 17.5% cases each. The mean age of the cohort was 32.5 ± 5.5 years details depicted in figure 1.

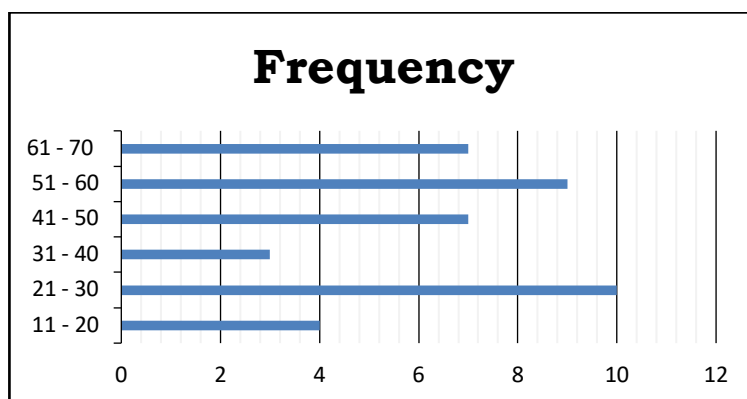


Figure 1: Distribution of cases based on the age groups

In the current study most commonly reported symptoms were fever in 100% of cases followed by nausea and vomiting in 55% of cases. Fever was reported in 52.5% of cases. The other details of the symptoms reported in the study are given in Table 1.

Table 1: Showing the symptoms reported by the patients in the study

<i>Symptoms</i>	<i>Frequency</i>	<i>Percentage</i>
Abdominal Pain	40	100.0
Nausea/Vomiting	22	55.0
Fever	21	52.5
Hematuria	15	37.5
Constipation	10	25.0
Abdominal distension	6	15.0

In our study, the most common cause of non-traumatic acute abdomen was the existence of urinary pathologies followed by hepatobiliary pathologies. GI pathologies were in 25% of cases and pancreatic pathologies in 12.5% of cases as shown in Table 2.

Table 2: Causes of non-traumatic acute abdomen diagnosed

<i>Causes</i>	<i>Frequency</i>	<i>Percentage</i>
Urinary Tract pathology	14	35
Hepatobiliary Pathology	11	27.5
G. I Pathology	10	25
Pancreatic Pathology	5	12.5
Total	40	100.0

Table 3: Urinary pathologies in the cases of the study

<i>Causes</i>	<i>Frequency</i>	<i>Percentage</i>
Renal calculi	6	42.85
Ureteric calculus	5	35.71
Vesical calculus	3	21.43
Total	14	100.0

Common urinary pathologies have been shown in Table 3. Renal calculi were the cause of non-traumatic acute abdomen in 42.58% of cases followed by ureteric calculus in 35.71% and vesical calculus in 21.43% of cases.

Table 4: Hepatobiliary pathologies in the cases of the study

<i>Causes</i>	<i>Frequency</i>	<i>Percentage</i>
Cholelithiasis	4	36.36
Cholecystitis	2	18.18
Liver abscess	5	45.45
Total	11	100.0

The study findings showed that hepatobiliary lesions comprised cholelithiasis in 36.36% of cases, chronic cholecystitis in 18.18% of cases, and liver abscess in 45.45% of cases, as presented in Table 4. Likewise, the incidence of GI pathologies, as indicated in Table 5, demonstrated acute appendicitis as the leading cause of acute abdomen in 50% of cases, followed by intestinal obstruction in 30% of cases, and intestinal perforation in 20% of cases.

Table 5: Gastro intestinal pathologies in the cases of the study

<i>Causes</i>	<i>Frequency</i>	<i>Percentage</i>
Acute Appendicitis	5	50
Intestinal obstruction	3	30
Intestinal perforation	2	20
Total	10	100.0

This study revealed the predominant diagnostic findings of pancreatitis on CECT. Notably, 80% of cases exhibited an enlarged pancreas, along with intra/extrapancratic collections, while 60% of cases showed altered enhancement. Additionally, 60% of cases displayed less than 30% necrosis, while 40% exhibited greater than 30% necrosis. Furthermore, a significant majority (60%) of cases experienced extrapancreatic complications like pleural effusion and ascites, which were attributed to the severity of the disease details depicted in Table 6.

Table 6: MDCT findings in patients with pancreatitis

MDCT	Frequency	Percentage
Bulky pane	4	80
Altered enhancement	3	60
Intrapancreatic collection / Extrapancreatic collection	4	80
Necrosis < 30%	3	60
Necrosis > 30%	2	40
Pseudo cyst	1	20
Dilated main pancreatic duct	2	40
Pleural effusion/ Ascites	3	60

Discussion

Acute abdominal pain is a frequently encountered complaint among patients visiting the emergency department, with approximately 4%–5% of all ED patients reporting such symptoms. [7] Initially, a careful medical history and physical examination are conducted to begin the diagnostic process for these cases. Based on the outcomes of this clinical evaluation and laboratory tests, medical practitioners may decide to employ imaging examinations to aid in arriving at an accurate diagnosis. [8] The term "acute abdomen" is commonly used to describe the condition of acute abdominal pain observed in a subgroup of seriously ill patients who exhibit abdominal tenderness and rigidity. In the past, before widespread imaging use, such individuals were often recommended for surgery. However, with the advent of advanced imaging techniques, some patients with acute abdomen can now be managed without surgical intervention. Conversely, other patients with acute abdominal pain do not meet the specific criteria for acute abdomen, such as those suspected of having acute appendicitis, and may require surgical treatment. Throughout this article, we will utilize the term "acute abdominal pain" to encompass the entire range of acute abdominal pain in patients treated in the ED, for whom imaging is necessary. [9]

Our study found a notable incidence of acute abdomen in young to middle-aged patients, with a male predominance, and the most frequent location of pain was reported in the right hypochondrium. L. Chanana et al. [10] also observed similar prevalence rates concerning age, sex, and site. Among the cases analyzed, urinary tract pathology was the most prevalent, accounting for 35% of cases, followed by hepatobiliary issues in 25% of cases, gastrointestinal pathology in 27.5% of cases, and pancreatic causes in 12.5% of cases. The common culprits of acute abdomen identified in our study included urolithiasis, cholecystitis, pancreatitis, intestinal obstruction, and liver abscess. These findings align with the results obtained by Abujudeh HH et al. [12] in their study.

In this study, urolithiasis emerged as a common cause of acute abdomen, linked to the geographical and warm climatic conditions of Telangana. The use

of underground water sources (borewells) for drinking, containing elevated levels of hard minerals, is identified as a contributing factor to the occurrence of urolithiasis. Other research studies [11, 12] have also supported the finding that urolithiasis is a frequent cause of acute abdomen.

In the study conducted by Abujudeh HH et al. [12] intestinal obstruction emerged as the second most frequent cause of acute abdomen, while in our study, it ranked fourth. This variation suggests a higher prevalence of obstruction in the Western world when compared to the Asian region. Such disparities have been attributed to differences in dietary habits, with increased consumption of low cellulose and high animal fat in Western diets. Similar findings have been reported in other studies as well. [12-14] Within this study, the CECT abdomen demonstrated higher accuracy in diagnosing cases of acute calculus cholecystitis compared to clinical provisional diagnosis. Stoker J et al. [15] also assessed CECT findings in acute cholecystitis and concluded that CT is a superior modality when compared to clinical and lab-based diagnoses of cholecystitis.

In this study, all cases of acute appendicitis that had a clinical provisional diagnosis of acute appendicitis were confirmed using CECT abdomen, indicating a 100% efficiency of CECT in this regard. Funaki B et al. [16], reported a sensitivity of 97% for CT in diagnosing acute appendicitis, while de Burlet KJ et al. [17] reported a sensitivity range of 90% to 95%, and van Randen A et al. [18] found an accuracy of 94% for diagnosing acute appendicitis. Regarding intestinal perforation, out of the two diagnosed cases in this study, only one had a provisional diagnosis of perforation. However, Gore RM et al. [19] reported that CT was 100% accurate in diagnosing and locating perforations. In this current study, all cases of pancreatitis were diagnosed using CECT, corresponding with the provisional diagnosis of pancreatitis. Orkin SH et al. [20] observed a sensitivity of 62 – 67% for pancreatitis detection using CT. Additionally, Balthazar EJ [21] reported an early overall detection rate of 90% with nearly 100% sensitivity after 4 days of pancreatic necrosis using CT. In the present study, CECT findings of all cases of pancreatitis were diagnosed with provisional diagnosis of pancreatitis.

Conclusion

Acute abdominal pain is a common symptom seen in the emergency department. Due to its subjective nature and the wide range of potential causes, imaging plays a crucial role in accurately diagnosing the underlying condition. Proper diagnosis is essential for effective management and reducing complications and mortality. While radiography is available, its use is mostly limited to cases of hollow-viscus perforation and intestinal obstruction. Ultrasound (USG) may be inconclusive in the presence of excessive bowel gas or abdominal fat, hindering the visualization of abdominal organs. Despite the slight increase in cost and the small risk of radiation, the prompt use of CT in investigating acute abdomen cases results in more accurate diagnoses and improves decision-making, ultimately leading to better patient outcomes.

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