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EFFICACY OF MULTI-DETECTOR COMPUTED TOMOGRAPHY IN DIAGNOSING ACUTE ABDOMEN: A PROSPECTIVE OBSERVATIONAL STUDY IN A TERTIARY CARE CENTER

Medical Science

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ABSTRACT

Background: Acute abdominal pain is a common clinical presentation with diverse underlying causes, requiring prompt and accurate diagnosis to guide treatment. Multi-detector computed tomography (MDCT) has become the preferred imaging modality for evaluating acute abdomen due to its ability to provide detailed anatomical information. This study aimed to assess the efficacy of MDCT in diagnosing various acute abdominal pathologies. **Aim and Objective:** To evaluate the diagnostic accuracy of MDCT in patients with acute abdominal pain, comparing its findings with surgical, histopathological, and clinical outcomes. **Materials and Methods:** This prospective observational study was conducted over 24 months at the Department of Radio-diagnosis, Sri Aurobindo Institute of Medical Science, Indore, Madhya Pradesh. A total of 60 patients presenting with acute abdominal pain were enrolled. MDCT findings were compared with intraoperative, histopathological, and clinical recovery data. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of MDCT were calculated. **Results:** MDCT demonstrated a sensitivity of 97.2%, specificity of 75%, PPV of 98.33%, and NPV of 60%. The most common pathology identified was appendicitis (21.6%), followed by bowel obstruction (16.7%) and acute pancreatitis (15%). In 81.6% of cases, surgical intervention was required, while 18.4% were managed conservatively. MDCT findings were 97% concordant with the final diagnoses. **Conclusion:** MDCT is a highly accurate and sensitive diagnostic tool for evaluating acute abdominal pain. Its ability to distinguish between surgical emergencies and conservatively managed conditions significantly improves clinical decision-making, leading to better patient outcomes. This study reinforces MDCT as an essential modality in the emergency management of acute abdomen.

KEYWORDS

Acute abdomen, computed tomography, MDCT, diagnostic accuracy, appendicitis, bowel obstruction, acute pancreatitis, prospective study.

INTRODUCTION

Acute abdominal pain is a common clinical presentation that encompasses a wide range of underlying pathologies, some of which may require urgent medical or surgical intervention.[1] Proper diagnosis is critical in the management of these conditions, as a delayed or incorrect diagnosis can lead to complications, morbidity, or even mortality. [2] Traditionally, a combination of clinical history, physical examination, and laboratory investigations has been used to diagnose the cause of acute abdominal pain.[3] However, imaging modalities, particularly computed tomography (CT), have increasingly become central to the diagnostic process due to their ability to provide detailed visualization of internal structures.[3,4]

Computed tomography has revolutionized the approach to evaluating acute abdomen, offering rapid, non-invasive, and highly accurate diagnostic capabilities.[5] Its cross-sectional imaging allows clinicians to visualize anatomical abnormalities in fine detail, assisting in identifying a wide array of abdominal pathologies.[6] From gastrointestinal perforations to vascular emergencies and organ-specific conditions like appendicitis or pancreatitis, CT provides critical information that may not be evident on clinical examination or basic radiographic imaging.[5,6]

The present study aims to evaluate CT's efficacy in diagnosing various pathologies associated with acute abdomen. By analyzing its role in detecting the underlying causes of abdominal pain, we aim to assess CT's sensitivity and specificity as a diagnostic tool in the emergency setting. Additionally, this study seeks to correlate CT imaging findings with surgical, histopathological, and clinical outcomes to confirm its reliability and diagnostic accuracy.

MATERIALS AND METHODS

This prospective observational study was designed to evaluate the efficacy of computed tomography (CT) in diagnosing various acute abdominal pathologies. The study focused on 60 patients presenting with acute abdominal pain and associated symptoms, who were referred for CT imaging, allowing for real-time observation and data collection over the study period. Conducted at the Department of Radio-diagnosis, Sri Aurobindo Institute of Medical Sciences and Post Graduate Institute, Madhya Pradesh, a tertiary care centre serving a predominantly rural population in central India, the research utilized the hospital's advanced imaging modalities, including a 128-slice CT scanner. The study was carried out over 24 months, starting after receiving approval from the Institutional Ethical Committee, providing ample time to observe and evaluate a sufficient number of acute abdomen cases.

The study included patients aged 18 years and older who presented with clinical symptoms of acute abdominal pain, abdominal guarding, fever, or vomiting. Patients provided written informed consent to participate in the study. Exclusion criteria included patients with contraindications to contrast media, those aged less than 18 years, post-traumatic patients, and those who were unwilling or uncooperative during the procedure.

CT Procedure: CT imaging was performed using a 128-slice Philips CT scanner. Patients were supine, arms raised above their heads, and the abdomen centred within the gantry. A non-enhanced CT (NECT) scan of the abdomen was conducted, spanning from the diaphragm to the symphysis pubis in a single breath-hold. The kVp and mAs parameters were automatically controlled by the CT machine, and raw data were acquired with a section thickness of 0.625 mm and a pitch of 0.8 to 1.5.

After the initial non-contrast phase, 1-2 ml per kg of body weight of a water-soluble non-ionic IV contrast medium with iodine content of 275-370 mg was administered at a 4 ml/sec rate using a power injector. Post-contrast scans were obtained in arterial, venous, and delayed phases at 25 seconds, 45 seconds, and 7 minutes, respectively, utilizing bolus tracking and automated triggering technology. Additionally, oral contrast was administered one hour before the procedure, consisting of a 30 ml ionic contrast medium containing 250 mg I/ml diluted in 1 litre of water.

Data Collection

The CT scan was used to evaluate any pathology's size, location, and gross structure. Additional investigations, including biochemical, blood, and urine analysis, were conducted. Where necessary, histopathological analysis was also performed to confirm diagnoses. Information collected from patients was documented in a case record proforma.

Statistical Analysis

Data from 60 subjects were analyzed using SPSS version 22.0. Continuous data were expressed as mean ± standard deviation (Min-Max), while categorical data were presented as numbers and percentages. Depending on data distribution, quantitative variables were analyzed using appropriate parametric or non-parametric tests. Chi-square tests assessed associations between categorical variables, and the Mann-Whitney test was applied to continuous data. A p-value

<0.05 was considered statistically significant for all analyses.

RESULTS

A total of 60 patients presenting with acute abdominal pain were evaluated using multi-detector computed tomography (MDCT), and the results were compared with surgical, histopathological, and clinical findings.

Demographic Data

The study population primarily consisted of individuals aged 31 to 40 (31.6%), followed by those aged 41 to 50 (21.6%). The least represented age group was 71 to 80 (6.7%). Most patients were male (75%, n = 45), while females accounted for 25% (n = 15).

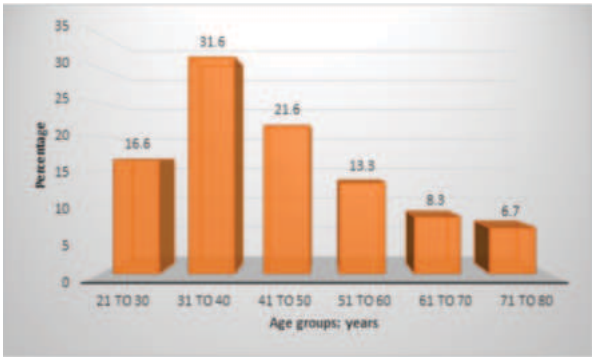

Figure 1: Age Distribution In The Study Population

Pathological Findings

MDCT identified a range of abdominal pathologies. Appendicitis was the most frequent diagnosis, accounting for 21.6% of cases (n = 13). Other common findings included bowel obstruction (16.7%) and acute pancreatitis (15%). Less common pathologies included perforation (13.3%), urolithiasis (6.7%), and cholecystitis (5%). Conditions such as bowel ischemia, aortic dissection, and aortic aneurysm were rare, each accounting for less than 5% of cases.

Table 1: Distribution Of Patients As Per Pathological Findings

Pathology	Frequency	Percentage (%)
Appendicitis	13	21.6
Bowel Obstruction	10	16.7
Acute Pancreatitis	9	15
Perforation	8	13.3
Urolithiasis	4	6.7
Cholecystitis	3	5
Bowel Ischemia	2	3.3
Aortic Dissection	1	1.7

Gender-specific distribution revealed that pathologies like appendicitis were more common in males (9 out of 13 cases), as were bowel obstruction (8 out of 10 cases) and acute pancreatitis (8 out of 9 cases). Female patients presented more frequently with urolithiasis (1 out of 4 cases) and bowel ischemia (1 out of 2 cases). Most cases of appendicitis were in patients aged 31 to 40 years (46%), with the majority being male. Cases of bowel obstruction were distributed across all age groups, with a slight male predominance (80%). The most common underlying causes of bowel obstruction include strictures and adhesions. Predominantly affecting males, acute pancreatitis was most common in the age group 31 to 40 years. Perforation was detected in 13.3% of the patients, with the majority being males and most cases distributed across the 31 to 50 age group. Urolithiasis was detected in 6.7% of cases, with the majority being male (75%).

Diagnostic Accuracy of MDCT

MDCT demonstrated a high degree of accuracy in diagnosing acute abdominal conditions. Its sensitivity was 97.2%, with a specificity of 75%. The positive predictive value (PPV) was 98.33%, while the negative predictive value (NPV) was 60%. Overall, MDCT findings were 97% concordant with the final diagnosis based on surgical, histopathological, or clinical recovery outcomes, with only 3% discordance.

Table 2: Diagnostic Accuracy of MDCT in Evaluating Acute Abdomen

Parameter	Value
Sensitivity	97.2%
Specificity	75%
Positive Predictive Value	98.33%
Negative Predictive Value	60%
Overall Accuracy	97%

Surgical and Conservative Management

Among the 60 patients, 49 cases (81.6%) underwent surgical management, with the most common surgeries performed for appendicitis (13 cases), bowel obstruction (9 cases), and perforation (8 cases). Additionally, 11 cases (18.4%) were managed conservatively, primarily for conditions like acute pancreatitis (7 cases) and diverticulitis (2 cases). Conservative management was predominantly used for acute pancreatitis (7 cases) and diverticulitis (2 cases).

Table 3: Distribution of patients as per surgical management given

Surgical Management	Frequency
Appendicitis	13
Bowel Obstruction	9
Perforation	8
Urolithiasis	4
Bowel Ischemia	3

Concordance of CT Findings with Final Diagnosis

MDCT findings showed a strong correlation with the final clinical outcomes. Of the 60 cases, 58 (97%) had findings concordant with the final surgical or histopathological diagnosis, with only 2 cases (3%) showing discordance. This high level of concordance underscores the reliability of MDCT in evaluating acute abdomen pathologies. The overall accuracy rate of MDCT in diagnosing acute abdomen pathologies was 97%. The high sensitivity, specificity, and positive predictive value demonstrate MDCT's reliability as an essential diagnostic tool in the emergency setting.

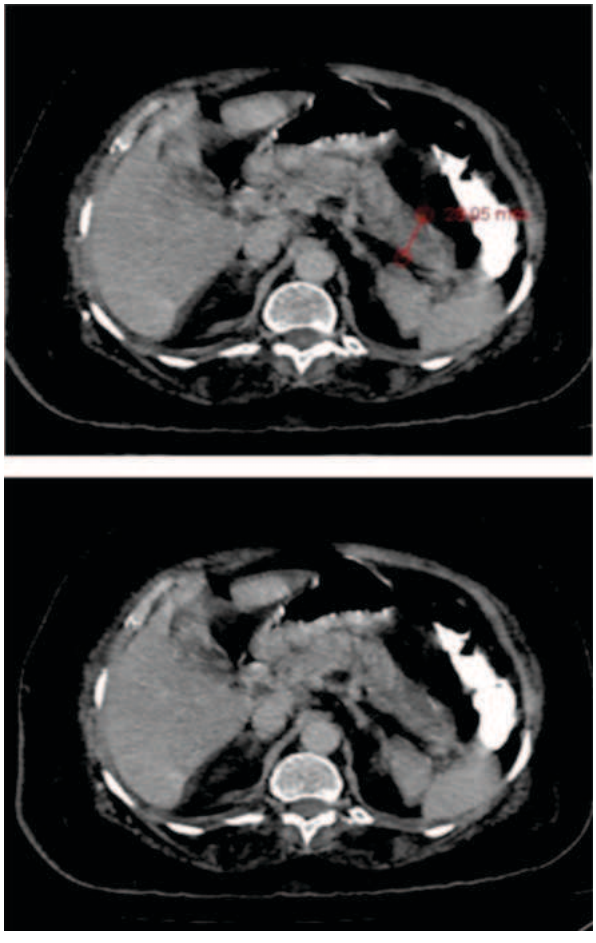

Figure 2: Axial contrast-enhanced computed tomography scan of a 45-year-old male patient with diffuse pancreatic parenchymal enlargement predominantly affected the body and tail with decreased attenuation. Indistinct pancreatic margins with surrounding retroperitoneal fat stranding. Few peripancreatic and periportal lymph nodes noted.

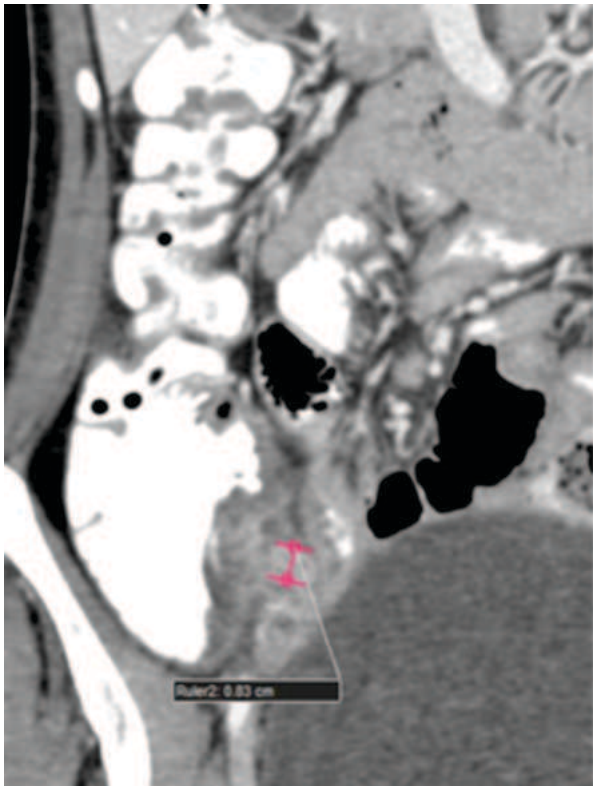

Figure 3: A tubular structure with a blind end is observed in the right iliac fossa, originating from the ileocecal junction at the 3 o'clock position. It measures approximately 9 mm in its maximum anteroposterior (AP) dimension, with mild adjacent fat stranding, which is suggestive of acute appendicitis.

DISCUSSION

This prospective study aimed to evaluate the efficacy of multi-detector computed tomography (MDCT) in diagnosing acute abdomen pathologies in 60 patients. The findings demonstrated MDCT's high diagnostic accuracy, with a sensitivity of 97.2%, specificity of 75%, and overall accuracy of 97%, making it an invaluable tool in the evaluation of acute abdominal pain. These results are consistent with previous studies, affirming the role of CT as the gold standard for imaging in acute abdomen cases.

The results of this study align with those from several previous investigations that have assessed the utility of CT in diagnosing acute abdominal conditions. In the current study, MDCT showed a sensitivity of 97.2% and a specificity of 75%, which is consistent with findings from a study by Mangini M et al.[7] Chaurasia R et al.[8] also reported that the sensitivity, accuracy rate, and positive predictive value of MDCT for diagnosing cases were 95.83%, 94.16%, and 98.33%, respectively. Mackersie et al., [9] also reported sensitivity, specificity, and accuracy rates of MDCT as 96%, 95%, and 95.6%, respectively. Similarly, Weir-McCall et al. conducted study 10, which compared preoperative CT findings with operative findings in 97 patients with an accuracy rate ranging from 78–93%. These studies were in agreement with the results of the present study. This study's slight variability in specificity may be attributed to differences in patient population and the range of pathologies encountered.

MDCT in Diagnosing Specific Pathologies:

In the present study, appendicitis was the most commonly detected pathology, accounting for 21.6% of cases, and MDCT demonstrated excellent diagnostic accuracy. Similar findings have been reported in the literature, with Rao et al.[11] confirming that CT has a sensitivity of 94% and specificity of 95% in diagnosing appendicitis, making it the preferred modality for diagnosing this condition.

MDCT was able to detect bowel obstruction with a high degree of accuracy in 16.7% of cases. Frager et al.[12] reported that CT has a sensitivity of 93% and specificity of 100% in diagnosing mechanical bowel obstruction, and the current study's findings agree with these results. The ability of MDCT to differentiate between simple and complicated obstructions (e.g., volvulus, hernias) has been crucial in guiding surgical intervention.

This study identified 15% of patients with acute pancreatitis. Bollen et al.[13] have previously demonstrated that MDCT is critical in detecting complications like necrotizing pancreatitis, with an accuracy rate of over 90%. This reinforces the present study's findings, where MDCT helped diagnose pancreatitis and assess its severity.

Surgical vs. Conservative Management

Of the 60 patients, 81.6% underwent surgical management, and 18.4% were managed conservatively. This surgical rate is comparable to that reported by Stoker et al.,[14] where approximately 75% of patients with acute abdomen required surgery, with CT guiding most of those decisions. MDCT's ability to distinguish between surgical emergencies and conditions that can be managed conservatively (such as acute pancreatitis or diverticulitis) is critical in reducing unnecessary surgical interventions and improving patient outcomes.

Diagnostic Concordance

This study's high concordance rate of 97% between MDCT findings and the final diagnosis (surgical, histopathological, or clinical) is significant. This high level of accuracy is comparable to the 95-98% concordance rates reported by Mangini M et al.,[7] further solidifying MDCT as a reliable diagnostic tool. The few discordant cases in the current study involved complex or rare pathologies, highlighting the challenges in diagnosing less common conditions.

Limitations and Strengths

One limitation of this study is the relatively small sample size, which may not fully capture the diversity of acute abdomen cases. Larger, multicenter studies are required to confirm these findings across broader patient populations. Additionally, the study was conducted in a single tertiary care centre, which may not fully represent the diagnostic challenges faced in smaller or less well-equipped hospitals.

However, the study's strengths include the prospective design and the use of a standardized MDCT protocol, which enhanced the reliability of the findings. Comparing imaging results with surgical and histopathological outcomes also added robustness to the diagnostic accuracy assessment.

CONCLUSION

In conclusion, this study's findings underscore the value of MDCT in diagnosing a wide range of acute abdomen pathologies. With its high sensitivity, specificity, and diagnostic accuracy, MDCT has become a critical tool in emergency settings, guiding surgical and conservative management decisions. The study's results align with existing literature, further emphasizing the role of CT in improving patient outcomes in cases of acute abdominal pain.

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