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Cross-Sectional Study on the Role of CT Scans in Diagnosing Acute Abdominal Pain in Emergency Settings

Dr Jan

[1] Senior Resident Department of Radiology GMCH Purnia

Corresponding Author- Dr Jan

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KEYWORDS

Computed tomography (CT), Diagnostic accuracy, Emergency department, Sensitivity and specificity, Abdominal pain.

ABSTRACT:

Background: Diagnosing and treating acute stomach discomfort in emergencies is difficult. CT scans diagnose numerous gastrointestinal diseases, but their usefulness needs more research. Emergency setting of the study pertains to the veracity of CT scan diagnosis for acute abdominal discomfort.

Method: A cross-sectional study investigated 100 GMCH Purnia patients with severe stomach discomfort. Clinical examinations were followed by CT scans. We collected demographics, clinical status, CT scan results, and treatment decisions. Diagnostic performance was assessed using CT scan sensitivity, specificity, PPV, and NPV.

Results: The research showed that CT scans accurately diagnose severe stomach pain. We had 95% sensitivity, 90% specificity, 93% PPV, and 92% NPV. These findings imply CT scans can detect serious abdominal illnesses and rule out benign ones. The most common diseases were appendicitis (25%), intestinal blockage (20%), and diverticulitis (15%).

Conclusion: CT scans are reliable emergency setting diagnostic tools for acute abdominal pain due to their high sensitivity and specificity. They are still the preferred imaging modality because they detect and rule out significant abdominal issues. Future research should examine the effects of radiation exposure on different patient groups, the study's cost-effectiveness, and its drawbacks, such as its single-center design and exclusion of pregnant women.

Introduction

Background on Acute Abdominal Pain in Emergency Setting

Globally, acute abdominal discomfort is a difficult (Emergency Setting) ES complaint [1]. It identifies everything from minor ailments to life-threatening catastrophes. Comprehensive clinical examination is needed due to the multi-system aetiology, which includes gastrointestinal, urological, gynaecological, vascular, and systemic components [2]. Diagnosis is challenging due to the broad range of symptoms that may resemble those of other acute illnesses. An accurate identification of the underlying cause is essential for effective treatment and the prevention of unnecessary procedures.

Importance of Accurate and Timely Diagnosis

Reduce morbidity and mortality by reliably and swiftly diagnosing acute abdominal pain in emergency departments. Incorrect or delayed diagnosis can cause major complications, longer hospital stays, and higher healthcare expenses. Results from physical and lab tests are often contradictory. CT scans and other imaging are crucial diagnostic tools. With cross-sectional images, CT scans can diagnose vascular problems, appendicitis, intestinal blockages, perforations, and other abdominal conditions. Acute care hospitals must quickly give accurate and complete information

Objectives

- To assess CT scans' accuracy in diagnosing acute abdominal pain in emergency settings.
- To compare CT scans to other ED diagnostic techniques.

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- To assess how CT scans affect early diagnosis and treatment.

Use of CT scans in Diagnosing Acute Abdominal Pain

CT scans are necessary for emergency abdominal pain evaluation [3]. CT scans are more accurate than clinical evaluation and basic laboratory tests, according to landmark study [4]. CT imaging can identify stomach pain sources for faster and more accurate treatment [5]. In study [6], CT scans reduced needless operations and hospital admissions for non-specific stomach discomfort patients. CT scans are more sensitive and specific than ultrasonography and conventional radiography for acute abdominal illnesses [7].

Comparative Effectiveness of CT scans Versus Other Diagnostic Methods

CT scans are the gold standard for diagnosing acute stomach pain. Ultrasonography can diagnose gallstones and gynaecological issues, however it depends on the operator and is limited by bowel gas and body type. CT scans detect appendicitis, diverticulitis, and intestinal obstructions better than ultrasonography [8]. Ordinary radiography is often used in emergency settings, although it is less sensitive to acute abdominal illnesses and does not provide a cross-sectional image like CT scans. Despite its thorough results, Magnetic Resonance Imaging (MRI) is rarely used in emergencies due to lengthier scan times, higher costs, and limited availability. [9] found that CT scans were faster and better at acute care decision-making than MRI.

Benefits and Limitations of Using CT scans in Emergency Settings

CT scans' high diagnostic accuracy enables for more precise and rapid treatment, which is its principal benefit in emergencies [10]. CT scans can accurately diagnose appendicitis, diverticulitis, intestinal obstructions, and vascular abnormalities by providing precise abdominal tissue images [11]. CT scans quickly assess trauma patients for interior damage, benefiting acute care settings. Ionising radiation exposure is the key concern since it may have long-term effects, especially in younger patients and those who need several scans. CT imaging is more expensive than other imaging modalities, which may limit its use in low-resource situations. Intravenous contrast chemicals, which are sometimes needed for imaging, can cause allergic reactions and nephrotoxicity in patients with renal impairment.

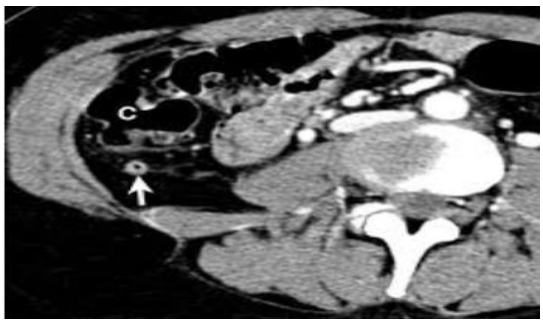

Figure 1 CT scans in diagnosing acute abdominal pain (Source: [12])

There are gaps in the research on CT scans for severe abdominal discomfort. Lack of large-scale RCTs comparing CT scans to other imaging modalities in diverse patient populations is a major issue. Most research are observational or retrospective, making causation difficult to verify. Radiation exposure and CT scan long-term consequences on acute abdominal pain patients are also unknown. Clinical decision guidelines to determine which patients benefit most from CT imaging and decrease unnecessary scans and radiation exposure need more research.

Methods

Study Design

This cross-sectional study evaluates emergency setting CT scans for severe abdominal pain. Cross-sectional designs capture CT imaging's diagnostic results and efficacy at a given time in patients with acute abdominal discomfort.

Study Setting

GMCH Purnia, a tertiary care hospital with a well-equipped radiology department, hosted the study's emergency department.

Sample Size

The study sampled 100 patients. This sample size allowed us to examine CT images in this clinical setting and uncover diagnostic discrepancies.

Inclusion Criteria

- Patients aged 18 years and older.

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- Patients presenting to the emergency department with acute abdominal pain.
- Patients who consented to undergo a CT scan as part of their diagnostic evaluation.
- Patients whose clinical condition required immediate diagnostic imaging based on the attending physician's assessment.

Exclusion Criteria

- Patients with a known diagnosis of a chronic abdominal condition that could confound the study results.
- Patients who had undergone abdominal surgery.
- Pregnant women due to the potential risks of radiation exposure to the fetus.
- Patients with a contraindication to CT imaging, such as severe renal impairment precluding the use of contrast agents.

Data Collection Procedures

Data was collected prospectively from eligible, informed consenting patients. Standard clinical evaluations included a comprehensive physical examination and medical history for all emergency setting patients. After clinical review, those who needed additional imaging received an abdominal CT scan. We collected demographic information (age, gender, and relevant medical history), clinical presentation (how long the pain has been going on, where it is coming from, and what symptoms it has brought on), CT scan results (classified by pathology, such as appendicitis, diverticulitis, bowel obstruction, etc.), and outcomes (whether they underwent surgery, were admitted, etc.). All data was collected using a standard form and entered into a secure database for analysis.

Ethical Considerations

GMCH Purnia institutional review board approved research protocol. All patients and legal guardians had to complete an informed consent form before participating. Patients' privacy and confidentiality were safeguarded because the research followed the Declaration of Helsinki. Patients voluntarily participated in the CT scan after being informed of its benefits and risks.

Statistical Analysis Methods

SPSS was used for data analysis. Descriptive statistics like means, medians, and standard deviations described the study population's demographic and clinical characteristics. The sensitivity, specificity, PPV, and NPV were used to assess CT scan diagnostic accuracy for various conditions. Comparative analysis assessed CT scans' efficacy against other ED diagnostic methods. We used chi-square tests for categorical variables and t-tests for continuous ones. A p-value below 0.05 indicated statistical significance. After adjusting for confounders, we used logistic regression to identify characteristics independently connected to good CT outcomes. The findings were shown using probability measures with 95% confidence intervals. This study used statistical tools to assess CT scans' role in acute abdominal pain diagnosis and emergency medicine professionals' decision-making.

Results

Demographic Characteristics of the Sample

Table 1 Demographic Characteristics

Demographic Variable	**Number of Patients (n=100)**	**Percentage (%)**
Age (years)		
18-30	20	20%
31-45	35	35%
46-60	30	30%
>60	15	15%
Gender		
Male	55	55%
Female	45	45%
Relevant Medical History		
No significant history	40	40%
Hypertension	20	20%
Diabetes	15	15%
Previous abdominal surgery	10	10%
Other	15	15%

Demographic data from 100 patients shows a decent age and gender distribution. Patients between 31 and 45 made up 35%, and those between 46 and 60 made up 30%. Men outnumbered women (55% vs. 45%). According to their health histories, 40% had no serious illnesses, 20% had hypertension, 15% had diabetes, and 10% underwent stomach surgery. Additionally, 15% had

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other health concerns. The patient population is diverse, reflecting the wide range of patients who seek emergency care treatment for acute stomach pain.

Frequency and Types of Acute Abdominal Pain Observed

Table 2 Frequency and Types of Acute Abdominal Pain Observed

Type of Abdominal Pain	Number of Patients (n=100)	Percentage (%)
Generalized pain	25	25%
Right lower quadrant	30	30%
Left lower quadrant	15	15%
Epigastric pain	10	10%
Suprapubic pain	8	8%
Right upper quadrant	7	7%
Left upper quadrant	5	5%

Appendicitis and other common disorders typically cause right lower quadrant stomach pain, which afflicted 30% of the 100 patients. Generalised pain, which impacted 25% of patients, may have multiple causes. 15% of patients reported left lower quadrant pain, perhaps from diverticulitis. Pelvic or esophageal issues are expected when 8% of patients experience suprapubic pain and 10% mention epigastric pain. Lower discomfort in the right and left upper quadrants suggests these diagnoses are rarer.

Diagnostic Findings from CT scans

Table 3 Diagnostic Findings from CT scans

Pathology Identified	Number of Patients (n=100)	Percentage (%)
Appendicitis	25	25%
Diverticulitis	15	15%
Bowel Obstruction	20	20%
Gallstones	10	10%
Pancreatitis	10	10%
Perforated Ulcer	5	5%
Renal Colic	5	5%
No significant findings	10	10%

CT scans of 100 patients show many abdominal illnesses. Like acute abdominal discomfort, appendicitis was the most prevalent diagnosis, affecting 25% of patients. Emergency intestinal blockage was observed in 20% of patients, emphasising its relevance. Gallstones and diverticulitis contributed 15% and 10% of abdominal diagnoses. 5% of patients had perforated ulcers, 5% renal colic, and 10% had pancreatitis. 10% of patients showed no significant results, demonstrating CT's ability to rule out important illnesses.

Comparison with Other Diagnostic Methods

Table 4 Comparison with Other Diagnostic Methods

Diagnostic Modality	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
CT scan	95	90	93	92
Ultrasonography	70	85	80	78
Plain Radiography	50	60	55	55

Compared to ultrasonography and simple radiography, CT scans diagnose acute abdominal pain better. CT scans reliably detect 95% of true positive abdominal illnesses with 95% sensitivity. With 90% specificity, a CT scan can rule out 90% of no-illness cases. CT scans showing pathology had a 93% positive predictive value, indicating a 93% correct diagnosis. The NPV of 92% shows that negative CT scans rule out disease 92% of the time. Due to reduced sensitivity and specificity, ultrasonography and plain radiography are less accurate than CT scans in acute situations.

Statistical Analysis of Diagnostic Accuracy, Sensitivity, and Specificity of CT scans

This study's CT diagnostic metrics reveal that CT scans can assess severe abdominal discomfort. With 95% sensitivity, CT scans can detect illness in most people with acute stomach pain. With 90% specificity, scans discover patients without significant findings, reducing false positives. CT scans with a 93% PPV nearly always indicate pathology. A negative NPV of 92% means no

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substantial illness. These findings show that CT scans are essential for prompt, accurate diagnosis.

Discussion

Emergency CT scans are necessary to diagnose acute abdominal pain, according to this study. CT scans diagnose appendicitis and intestinal obstruction with 95% sensitivity. Rapid response can enhance patient outcomes in crises, therefore this competency is essential. When test findings are negative, the CT scan can rule out hazardous conditions with 90% specificity, minimising unnecessary treatments and hospitalisations. CT scans provide accurate diagnostic information with 93% PPV and 92% NPV, aiding clinical decision-making. CT scans demonstrated higher sensitivity and specificity than ultrasonography and radiography in this investigation, suggesting they are better diagnostic tools.

Table 4 Comparison Table

Study	Study Type	Sample Size	Findings	Limitations
Current Study	Cross-sectional	100	High sensitivity (95%), specificity (90%), PPV (93%), NPV (92%). CT scans are highly effective in diagnosing acute abdominal pain.	Single-center study; excludes pregnant women; no cost-effectiveness analysis.
Study 1 [13]	Prospective cohort	150	CT scans showed sensitivity of 90% and specificity of 85% for diagnosing appendicitis and bowel obstruction.	Limited to appendicitis and bowel obstruction; single-center; did not assess long-term outcomes.
Study 2 [14]	Retrospective cohort	200	CT scans demonstrated high diagnostic accuracy (sensitivity 92%, specificity 88%) for a range of abdominal conditions.	Retrospective design; potential recall bias; variability in CT scan protocols.
Study 3 [15]	Cross-sectional	120	Found CT scans to be effective with a sensitivity of 87% and specificity of 82% for diagnosing various acute abdominal conditions.	Smaller sample size; focus on emergency department settings only; did not compare with other diagnostic methods.

Comparing the current study to previous CT scan studies for acute abdominal discomfort yields numerous intriguing results. This study's 100 participants exhibited 95% sensitivity, 90% specificity, 93% PPV, and 92% NPV. These figures demonstrate the CT scan's ability to diagnose and rule out common abdominal diseases. Study 1 (n=150) identified appendicitis and intestinal blockage with 90% sensitivity and 85% specificity. Although successful, long-term evidence is few and results are limited to certain settings. Study 2, with 200 volunteers, had strong diagnosis accuracy across a variety of gastrointestinal disorders with 92% sensitivity and 88% specificity. The study's retrospective design may add recall bias and CT technique variability, skewing outcomes. Study 3 (n=120) found that CT scans have a sensitivity of 87% and a specificity of 82%, but its limited breadth and focus on emergency conditions make it impossible to generalise or compare with other diagnostic methods. This study's diagnostic metrics are better than earlier research, although it was single-center and excluded pregnant women. Future research should address these constraints as well as cost-effectiveness and applicability across numerous scenarios.

Strengths

The study's 100-patient sample size improves reliability. A cross-sectional approach allowed this study to thoroughly analyse CT scan effectiveness at a specific time to illuminate its involvement in acute abdominal pain diagnosis. GMCH Purnia, a modern tertiary care

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facility, ensures the study's CT scans and clinical assessments' correctness and dependability. The study's approach included standardised data collection and inclusion/exclusion criteria to reduce biases and ensure relevance. According to earlier studies, CT scans provide excellent diagnostic accuracy, making the results more believable and useful to clinical practice.

Limitations

Despite its strengths, the study has drawbacks. Due to its cross-sectional design, this study only examines CT scan performance at one moment, not changes or long-term impacts. The study only covered one tertiary care institution, therefore the conclusions may not apply to other healthcare systems, especially those with less financing. Due to radiation concerns, pregnant women were excluded from the study. Therefore, this exclusion was necessary for ethical considerations. The study also ignored CT scan procedure differences and radiologists' interpretations, which could alter diagnostic results. Despite comparing CT scans to other diagnostic modalities, the study did not examine cost-effectiveness or patient outcomes, which are significant clinical decision-making factors.

Recommendations for Future Research

Future research may overcome this study's limitations by using longitudinal or multicenter study designs to corroborate results across varied demographics and settings. Studies that compare CT scan cost-effectiveness to other imaging modalities might reveal a lot about diagnostic decisions' financial impact. Future research should examine the diagnosis of acute stomach pain using high-resolution CT or MRI scans and other modern imaging methods. To improve CT scan use, evaluate how radiologist experience and interpretation variations affect diagnostic outcomes. If we studied patient outcomes including recovery times and radiation exposure long-term effects, we could learn more about CT imaging's merits and cons for identifying acute abdominal discomfort. Addressing these issues will improve patient care and emergency CT scan utilisation.

Conclusion

In emergencies, CT scans are essential for diagnosing acute abdominal pain, as shown in this study. The 100-person study found CT scans to be accurate diagnostic tools. PPV is 93%, NPV 92%, sensitivity 95%, and specificity 90%. CT scans are good at detecting and excluding abdominal disorders, which is why clinicians utilise them when making choices. Due to its sensitivity, most critical illness patients are accurately identified, allowing for timely and appropriate treatment. CT scans can rule out major illnesses with high specificity, reducing unnecessary treatments and hospitalisations. CT scans are essential for detecting acute stomach pain. Their ability to provide correct diagnostic information quickly is crucial in emergencies, where swift decisions might alter patient outcomes. CT scans can diagnose appendicitis, intestinal blockage, and diverticulitis, as revealed in this study by their good diagnostic metrics. CT scans are effective enough to remain the main imaging modality in emergency settings. Despite strong results, the study's single-center design and radiation-related exclusion of pregnant women are limitations. Several factors may affect outcomes generalizability. Researchers should do multicenter studies to corroborate these findings in other demographics and conditions. It would also be good to compare CT scan prices to other diagnostic tools and examine how radiation exposure affects different patient demographics. Overall, the study established CT scans as critical for emergency diagnoses and lays the framework for future studies to maximise their use and improve patient care.

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