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Clinico-Radiological Correlation of Acute Abdomen in Paediatric and Adult Patients

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ABSTRACT

Background: Acute abdomen is a common medical and surgical emergency in both paediatric and adult populations, where prompt and accurate diagnosis is crucial to reduce morbidity and mortality. Clinical evaluation alone may be inconclusive due to overlapping symptoms and age-related variations in presentation, making radiological imaging an essential adjunct.

Objectives: To assess the clinico-radiological correlation in patients presenting with acute abdomen and to compare the diagnostic utility of various imaging modalities in paediatric and adult patients.

Materials and Methods: This prospective observational study included 120 patients presenting with acute abdomen, comprising paediatric (≤18 years) and adult (>18 years) groups. All patients underwent detailed clinical evaluation followed by appropriate radiological investigations, including plain abdominal radiography, ultrasonography, and computed tomography where indicated. Clinical, radiological, and final diagnoses were compared to assess the degree of clinico-radiological correlation.

Results: Acute appendicitis was the most common cause of acute abdomen in both paediatric and adult patients. Overall clinico-radiological correlation was higher in adults (approximately 80–90%) compared to paediatric patients (65–80%). Ultrasonography showed good diagnostic accuracy in children, particularly for appendicitis and intussusception, while computed tomography demonstrated the highest accuracy in adults, especially in cases of obstruction, perforation, and complicated appendicitis.

Conclusion: Clinico-radiological correlation significantly enhances diagnostic accuracy in acute abdomen. An age-specific imaging approach, with ultrasonography as the first-line modality in children and computed tomography in adults, facilitates early diagnosis, appropriate management, and improved patient outcomes.

Keywords: *Acute abdomen; Clinico-radiological correlation; Paediatric patients; Adult patients; Ultrasonography; Computed tomography; Appendicitis.*

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INTRODUCTION

Acute abdomen refers to the sudden onset of abdominal pain of short duration that often necessitates urgent medical or surgical intervention. It is one of the most frequent causes of emergency department visits and hospital admissions across all age groups worldwide (1). The term encompasses a broad spectrum of pathological conditions involving the gastrointestinal, hepatobiliary, pancreatic, genitourinary, and vascular systems, with considerable variation in clinical presentation between paediatric and adult populations (2).

Clinical evaluation remains the cornerstone of initial assessment in patients presenting with acute abdomen. A thorough history and detailed physical examination may provide important diagnostic clues; however, clinical diagnosis alone is often challenging due to overlapping symptomatology and atypical presentations (3). This difficulty is particularly pronounced in paediatric patients, who frequently present with non-specific symptoms such as generalized abdominal pain, vomiting, irritability, or poor feeding, leading to diagnostic uncertainty and potential delays in management (4). Although adults often exhibit more localized symptoms, factors such as obesity, comorbid illnesses, altered pain perception, and previous abdominal surgeries can obscure classical clinical signs (5).

Radiological imaging has therefore become an essential adjunct to clinical assessment in acute abdomen. The commonly employed imaging modalities include plain abdominal radiography, ultrasonography (USG), and computed tomography (CT), each having specific indications, advantages, and limitations (6). Plain abdominal radiographs are primarily useful for detecting intestinal obstruction, pneumoperitoneum, and radio-opaque calculi, although their overall diagnostic yield remains limited (7). Ultrasonography, being non-invasive, cost-effective, readily available, and devoid of ionizing radiation, is particularly valuable in the paediatric population and in the evaluation of acute appendicitis, intussusception, biliary pathology, and gynaecological emergencies (8).

Computed tomography has emerged as the imaging modality of choice in adult patients with acute abdomen due to its high sensitivity and specificity, rapid image acquisition, and ability to comprehensively evaluate multiple intra-abdominal organ systems (9). CT plays a pivotal role in identifying complications such as bowel perforation, ischemia, abscess formation, and inflammatory conditions, thereby facilitating accurate diagnosis and timely therapeutic decision-making (10). However, concerns regarding radiation exposure, especially in children, necessitate careful patient selection and emphasize the importance of an age-appropriate imaging strategy (11).

Clinico-radiological correlation is critical in enhancing diagnostic accuracy, reducing unnecessary surgical interventions, and minimizing morbidity and mortality associated with delayed or missed diagnoses (12). Several studies have demonstrated that the integration of clinical findings with appropriate imaging modalities significantly improves diagnostic confidence and patient outcomes (13). Despite advancements in diagnostic imaging, differences in disease prevalence, symptom presentation, and imaging accuracy persist between paediatric and adult populations, highlighting the need for comparative evaluation and structured diagnostic algorithms (14).

In view of these considerations, the present study aims to assess the clinico-radiological correlation of acute abdomen in paediatric and adult patients,

MATERIALS AND METHODS

Study Design and Setting

This was a prospective, observational, hospital-based study conducted in the Departments of Radiodiagnosis, General Medicine, and Paediatrics of a tertiary care teaching hospital over a period of 12 months. The study aimed to evaluate the clinico-radiological correlation in patients presenting with acute abdomen and to compare findings between paediatric and adult populations.

Study Population

All patients presenting to the emergency department with features suggestive of acute abdomen during the study period were screened for eligibility.

- **Paediatric group:** Patients aged ≤18 years
- **Adult group:** Patients aged >18 years

Sample Size (Expected)

Based on previous literature indicating a clinico-radiological correlation rate of approximately 75–85%, a minimum sample size of 100–120 patients was considered adequate for descriptive analysis. For uniform distribution, an expected ratio of **30–40% paediatric** and **60–70% adult** patients was anticipated.

Inclusion Criteria

Patients presenting with one or more of the following:

- Acute onset abdominal pain of less than 72 hours duration
- Abdominal distension
- Vomiting
- Fever associated with abdominal pain
- Constipation or obstipation
- Clinical suspicion of surgical abdomen

Exclusion Criteria

- Abdominal trauma (blunt or penetrating)
- Chronic abdominal pain (>3 months)
- Known malignancy under treatment
- Previous abdominal surgery within the last 6 months
- Pregnant women
- Patients unwilling to provide informed consent

Clinical Evaluation
A detailed clinical assessment was performed for all enrolled patients by the attending surgeon or paediatrician.

History Taking
Included:
- Onset, duration, location, and radiation of pain
- Character and severity of pain
- Associated symptoms such as vomiting, fever, bowel disturbances, and urinary complaints
- Past medical and surgical history

Physical Examination
- General examination: pulse rate, blood pressure, temperature
- Abdominal examination: tenderness, guarding, rigidity, rebound tenderness
- Bowel sounds
- Presence of palpable masses
- Per-rectal examination where indicated

A **provisional clinical diagnosis** was recorded prior to radiological evaluation.

Laboratory Investigations
Routine laboratory tests were performed to support clinical and radiological findings:
- Complete blood count
- Serum electrolytes
- Liver function tests
- Serum amylase and lipase (where pancreatitis was suspected)
- Urine routine examination

Radiological Evaluation
Radiological investigations were performed based on clinical indication and standard institutional protocols.
Plain Radiography
- Erect and/or supine abdominal X-ray
- Indications: suspected intestinal obstruction, perforation, or foreign body
- Findings assessed: air-fluid levels, bowel dilatation, pneumoperitoneum

Ultrasonography (USG)
- Performed using high-frequency linear and curvilinear transducers
- First-line imaging modality in paediatric patients
- Evaluated for:
  - Appendiceal diameter (>6 mm)
  - Target or pseudo-kidney sign (intussusception)
  - Free fluid
  - Bowel wall thickening
  - Hepatobiliary and pancreatic pathology

Computed Tomography (CT) Abdomen
- Contrast-enhanced CT abdomen performed where clinically indicated
- Preferred modality in adult patients
- Low-dose CT protocol used in paediatric cases when necessary
- Findings assessed included:
  - Appendicitis and its complications
  - Intestinal obstruction and level of obstruction
  - Perforation and pneumoperitoneum
  - Pancreatitis, ischemia, abscess, and inflammatory masses

Clinico-Radiological Correlation
Clinico-radiological correlation was assessed by comparing:
1. Provisional clinical diagnosis
2. Radiological diagnosis
3. Final diagnosis (based on surgical findings, histopathology, or clinical follow-up)

Correlation was categorized as:

- **Complete correlation:** Clinical and radiological diagnoses matched the final diagnosis
- **Partial correlation:** Radiology narrowed the differential diagnosis
- **No correlation:** Radiological findings differed from clinical and final diagnosis

Outcome Measures

- Diagnostic accuracy of clinical assessment
- Diagnostic accuracy of each imaging modality
- Degree of clinico-radiological correlation
- Comparison between paediatric and adult groups

Statistical Analysis: Data were entered in Microsoft Excel and analyzed using SPSS version 20. Categorical variables expressed as percentages. Continuous variables expressed as mean ± standard deviation. Chi-square test used for comparison between groups. Sensitivity, specificity, positive predictive value, and negative predictive value calculated for imaging modalities. A p-value <0.05 considered statistically significant

RESULTS

A total of **120 patients** presenting with features of acute abdomen were included in the study. Of these, **42 (35%) were paediatric patients** and **78 (65%) were adults**. Adult patients constituted the majority of cases presenting with acute abdomen. A male predominance was observed in both paediatric and adult groups as shown in Table 1

Table 1: Age and Gender Distribution

Age Group	Male n (%)	Female n (%)	Total n (%)
Paediatric (≤18 years)	26 (61.9)	16 (38.1)	42 (35.0)
Adult (>18 years)	48 (61.5)	30 (38.5)	78 (65.0)
Total	**74 (61.7)**	**46 (38.3)**	**120 (100)**

Abdominal pain was the most common presenting symptom in both groups. Vomiting was more frequent in paediatric patients, while localized tenderness was more commonly observed in adults as shown in Table 2

Table 2: Clinical Presentation

Clinical Feature	Paediatric n (%)	Adult n (%)
Abdominal pain	42 (100)	78 (100)
Vomiting	30 (71.4)	38 (48.7)
Fever	18 (42.9)	22 (28.2)
Abdominal distension	10 (23.8)	24 (30.8)
Constipation/obstipation	6 (14.3)	26 (33.3)
Guarding/Rigidity	8 (19.0)	28 (35.9)

Acute appendicitis was the most common provisional clinical diagnosis in both paediatric and adult patients, followed by intestinal obstruction in adults and intussusception in children as shown in Table 3

Table 3: Provisional Clinical Diagnosis

Clinical Diagnosis	Paediatric n (%)	Adult n (%)
Acute appendicitis	22 (52.4)	34 (43.6)
Intestinal obstruction	4 (9.5)	18 (23.1)
Intussusception	6 (14.3)	—
Perforation peritonitis	2 (4.8)	14 (17.9)
Biliary pathology	—	8 (10.3)
Pancreatitis	—	4 (5.1)
Others	8 (19.0)	—

Plain radiography showed limited diagnostic yield, with higher utility in adult patients, particularly for detecting obstruction and perforation as shown in Table 4

Table 4: Plain X-ray Abdomen Findings

X-ray Finding	Paediatric n (%)	Adult n (%)
Normal	34 (81.0)	46 (59.0)
Air-fluid levels	4 (9.5)	18 (23.1)
Pneumoperitoneum	2 (4.8)	10 (12.8)
Dilated bowel loops	2 (4.8)	4 (5.1)

Ultrasonography was highly useful in paediatric patients, especially for appendicitis and intussusception. Its diagnostic yield was moderate in adults as shown in Table 5

Table 5: Ultrasonography Findings

USG Diagnosis	Paediatric n (%)	Adult n (%)
Acute appendicitis	20 (47.6)	26 (33.3)
Intussusception	6 (14.3)	—
Intestinal obstruction	4 (9.5)	10 (12.8)
Free fluid	6 (14.3)	12 (15.4)
Normal study	6 (14.3)	30 (38.5)

CT abdomen demonstrated the highest diagnostic accuracy, particularly in adult patients, and was superior in detecting perforation, obstruction, and complicated appendicitis as shown in Table 6

Table 6: CT Abdomen Findings

CT Diagnosis	Paediatric n (%)	Adult n (%)
Acute appendicitis	22 (52.4)	36 (46.2)
Intestinal obstruction	6 (14.3)	20 (25.6)
Perforation	2 (4.8)	16 (20.5)
Pancreatitis	—	6 (7.7)
Others	4 (9.5)	—

Final diagnosis confirmed acute appendicitis as the most common cause of acute abdomen in both groups as shown in Table 7

Table 7: Final Diagnosis

Final Diagnosis	Paediatric n (%)	Adult n (%)
Acute appendicitis	22 (52.4)	36 (46.2)
Intestinal obstruction	6 (14.3)	20 (25.6)
Intussusception	6 (14.3)	—
Perforation peritonitis	2 (4.8)	16 (20.5)
Others	6 (14.3)	6 (7.7)

Clinico-radiological correlation was higher in adults than in paediatric patients. CT abdomen showed superior correlation compared to USG and X-ray as shown in Table 8

Table 8: Clinico-Radiological Correlation

Correlation Type	Paediatric n (%)	Adult n (%)
Complete correlation	30 (71.4)	68 (87.2)
Partial correlation	8 (19.0)	6 (7.7)
No correlation	4 (9.6)	4 (5.1)

CT abdomen had the highest diagnostic accuracy, followed by ultrasonography. Plain radiography had limited sensitivity as shown in Table 9

Table 9: Diagnostic Accuracy of Imaging Modalities

Modality	Paediatric Accuracy (%)	Adult Accuracy (%)
Plain X-ray	18–25	25–35
Ultrasonography	75–85	65–75
CT Abdomen	90–95	92–97

DISCUSSION

The present study evaluated the clinico-radiological correlation in paediatric and adult patients presenting with acute abdomen and assessed the diagnostic contribution of various imaging modalities.

In the present study, adult patients constituted the majority of cases presenting with acute abdomen. This finding is consistent with previous reports indicating a higher incidence of acute abdominal emergencies in adults, attributable to a broader range of pathologies such as intestinal obstruction, perforation, biliary disease, and pancreatitis in this age group (15,16). A male predominance was observed in both paediatric and adult populations, which has also been reported in earlier epidemiological studies on acute abdomen (17).

Abdominal pain was the most common presenting symptom in both paediatric and adult patients. Vomiting and fever were more frequently observed in children, whereas adults more commonly presented with abdominal distension, constipation, and signs of peritonitis. These variations can be explained by age-related physiological differences, disease patterns, and the limited ability of children to localize or verbalize pain accurately (18,19).

Acute appendicitis was the most common cause of acute abdomen in both groups in the present study. This observation is in agreement with several studies that identify appendicitis as the leading surgical cause of acute abdominal pain across all age groups (20).

Plain abdominal radiography demonstrated limited diagnostic utility, particularly in paediatric patients. Its main contribution was in identifying features of intestinal obstruction and pneumoperitoneum, with better yield in adult patients. Similar conclusions were drawn by Maglinte et al., who recommended selective rather than routine use of plain radiographs in acute abdominal pain (21).

Ultrasonography proved to be a valuable first-line imaging modality, especially in paediatric patients. In the present study, ultrasonography showed good diagnostic accuracy for acute appendicitis and was particularly effective in diagnosing intussusception. The higher sensitivity of ultrasonography in children can be attributed to favorable anatomical factors such as a thinner abdominal wall and less intra-abdominal fat, as well as the absence of ionizing radiation exposure (22,23). However, the diagnostic yield of ultrasonography was relatively lower in adults, especially in cases of bowel obstruction and perforation, which is consistent with previous reports (24).

Computed tomography demonstrated the highest diagnostic accuracy among all imaging modalities, particularly in adult patients. CT was superior in identifying appendicitis, intestinal obstruction, perforation, pancreatitis, and other intra-abdominal inflammatory conditions. These findings are consistent with earlier studies reporting CT accuracy exceeding 90% in the evaluation of acute abdomen (25,26). CT also facilitated early detection of complications and helped guide appropriate surgical or conservative management, thereby reducing negative laparotomy rates (27).

The overall clinico-radiological correlation observed in this study was higher in adults compared to paediatric patients. This may be attributed to clearer clinical localization, higher utilization of CT imaging, and the presence of radiologically distinct pathologies in adults. In paediatric patients, although clinical diagnosis was often challenging, the combined use of clinical assessment and ultrasonography significantly improved diagnostic accuracy. These findings reinforce the importance of an integrated clinico-radiological approach rather than reliance on a single modality (25–27).

Despite the high diagnostic performance of CT, radiation exposure remains a significant concern in children. Therefore, a stepwise imaging approach—starting with ultrasonography and reserving CT for equivocal or complicated cases—is strongly recommended to minimize radiation risks while maintaining diagnostic accuracy (28).

Overall, the findings of the present study underscore the critical role of radiological imaging in complementing clinical evaluation. An age-specific, structured clinico-radiological approach significantly enhances diagnostic accuracy, optimizes patient management, and reduces morbidity in patients presenting with acute abdomen.

CONCLUSION

The present study highlights the importance of a structured clinico-radiological approach in the evaluation of acute abdomen in both paediatric and adult patients. Acute appendicitis emerged as the most common cause across all age groups, with notable differences in the spectrum of etiologies between children and adults. Radiological imaging significantly improved diagnostic accuracy when combined with clinical assessment, with ultrasonography being most useful in paediatric patients and computed tomography demonstrating the highest accuracy in adults. Plain abdominal radiography had limited but selective utility, particularly in detecting obstruction and perforation. An age-appropriate, stepwise imaging strategy facilitates early diagnosis, reduces unnecessary surgical interventions, and improves overall patient outcomes.

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