# Clinico-Demographic and Imaging Profile of Pediatric Patients with Abdominal Tuberculosis

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## Abstract

**Background:** Abdominal tuberculosis in children presents a diagnostic challenge because of its nonspecific clinical presentation and low microbiological yield. Imaging may support assessment in conjunction with clinical and laboratory findings.

**Objective:** To describe the clinico-demographic profile and modality-specific imaging findings of pediatric patients diagnosed with abdominal tuberculosis.

**Methods:** This retrospective study included 50 patients aged 1–14 years diagnosed with abdominal tuberculosis at a tertiary care center. Clinical and laboratory findings and the reported diagnostic categories were summarized descriptively. Abdominal ultrasound findings were available for 41 patients and contrast-enhanced CT findings for 22 patients. Imaging frequencies were described separately for each examined group.

**Results:** There were 28 males and 22 females, with a mean age of 8.2 ± 3.5 years. Clinical features included ascites in 36 patients (72%), abdominal pain in 31 (62%), and weight loss in 20 (40%). The reported diagnostic categories comprised 15 microbiologically confirmed, 25 histopathology-confirmed, and 10 probable cases. GeneXpert was positive in 15 patients (30%). Ascites was reported in 33 of 41 ultrasound examinations (80.49%) and 11 of 22 CT examinations (50%). Other reported imaging findings included lymphadenopathy, bowel wall thickening, hepatosplenomegaly, and mesenteric or omental involvement.

**Conclusion:** This retrospective series describes the clinical and imaging findings of children diagnosed with abdominal tuberculosis. Imaging findings should be interpreted together with clinical, microbiological, and histopathological information. These descriptive data do not establish diagnostic accuracy, differences between diagnostic categories, or improved treatment outcomes.

**Keywords:** Pediatric abdominal tuberculosis; ultrasound; computed tomography (CT); extrapulmonary tuberculosis; mesenteric lymphadenopathy

## Introduction

Abdominal tuberculosis (ATB) is an important form of extrapulmonary tuberculosis in children and poses significant diagnostic challenges, particularly in endemic regions. Although pulmonary tuberculosis is the most common manifestation in the pediatric population, abdominal tuberculosis accounts for approximately 0.3–4% of all childhood TB cases [1, 2, 3]. The clinical presentation of abdominal TB is nonspecific and has a wide spectrum, ranging from mild abdominal pain with lymphadenopathy and ascites to severe complications like intestinal perforation, bleeding, and obstruction. The diagnosis of abdominal TB remains challenging , and a high index of clinical suspicion is required. Histopathological observation of typical caseating granulomas has been reported in around 40% of abdominal TB, but more so in lymph node (LN) specimens only [4, 5]. Isolation of acid-fast bacilli (AFB) by microscopy or culture in body fluids or tissue biopsies is the diagnostic gold standard, but the yield is low [6]. Ascitic adenosine deaminase (ADA) levels have been reported sensitivity and specificity of 93% and 96% respectively, but they can have false negatives in malignant ascites and HIV [7]. The Cartridge-Based Nucleic Acid Amplification Test (CBNAAT) is a real-time PCR assay designed to detect Mycobacterium tuberculosis and rifampicin resistance. It offers rapid results with high specificity, though its sensitivity can be variable [8]. Radiological imaging may reveal suggestive but non-pathognomonic findings. The search for rapid clinical and investigational diagnosis and management of abdominal TB, which is crucial but still a challenge, continues.

To describe the clinico-demographic profile and modality-specific imaging findings of pediatric patients diagnosed with abdominal tuberculosis.


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## Methods

### Study Design and Setting

This retrospective study was conducted in the Departments of Radiodiagnosis and Pediatrics at Al-Falah School of Medical Science and Research centre, Faridabad, Haryana over a period of 1 year (May 2022 to May 2023 after getting approval from the Institutional Ethics Committee (IEC) (Ref, No AFSMS&RC/ F-01/23/106). Due to the retrospective design, a waiver of informed consent was granted, and all patient data were anonymized prior to analysis.

### Case Identification and Sampling

Patients were identified through review of hospital medical records, pediatric TB clinic registers, and radiology databases. Consecutive patients meeting eligibility criteria during the study period were included.

### Inclusion Criteria

• Patients in the age group of 1 year to 14 years

• Patients diagnosed with abdominal tuberculosis based on clinical and imaging features

• Availability of complete medical records

### Exclusion Criteria

• Patients less than 1 year and more than 14 years

• Patients with incomplete records

• Cases where an alternative diagnosis (e.g., lymphoma, Crohn's disease) was established

### Diagnostic Classification

Cases were classified into the following predefined categories:

1. Confirmed TB: Microbiological confirmation by AFB smear, culture, or CBNAAT/ GeneXpert positive from abdominal specimen including ascitic fluid, lymph node aspirate, bowel biopsy, or tissue sample).

2. Histopathology-Confirmed TB: Granulomatous inflammation with caseation consistent with tuberculosis on tissue sampling, with no alternative diagnosis.

3. Probable TB: Clinical features suggestive of TB with supportive epidemiology and imaging findings, negative microbiological/histopathological results, and documented clinical response to anti-tubercular therapy.

### Imaging Evaluation

Ultrasound and CT images were reviewed retrospectively from stored radiology records. Imaging had originally been interpreted by consultant radiologists as part of routine clinical care. For study purposes, reports were reviewed by two radiologists in consensus.

Ultrasound Technique: Abdominal ultrasound was performed using high-frequency linear and curvilinear probes (3–12 MHz). Doppler assessment was performed where indicated.

CT Technique: Contrast-enhanced CT (CECT) of the abdomen was performed in portal venous phase following intravenous contrast administration.

Imaging Definitions: - Necrotic lymph node: Enlarged node with central low attenuation and peripheral rim enhancement on CECT. - Bowel wall thickening: Circumferential wall thickness >3 mm in adequately distended small bowel. - Omental thickening/caking: Diffuse or nodular soft tissue infiltration of omental fat. - Ascites: Classified as free or loculated; internal echoes/septations noted on ultrasound.

### Statistical Analysis

Clinical characteristics, laboratory findings, diagnostic categories, and imaging findings were summarized descriptively using the reported counts and percentages. Ultrasound and CT findings were reported separately for the patients examined with each modality.


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## Results

Of the 50 patients, 22 were female (44%), and 28 (56%) were male. The age range was 1 year to 14 years, with a mean of 8.2 ± 3.5 years. The duration of symptoms ranged from 10 days to 3 years (mean: 109 days). In 22 cases (44 %), there was a history of contact with an adult diagnosed with pulmonary tuberculosis.

## Diagnostic Categories

• Confirmed TB (microbiological): 15 patients

• Histopathology-confirmed TB: 25 patients

• Probable TB: 10 patients

The most common symptoms and signs were ascites, abdominal pain, abdominal distention, weight loss, and fever (Table 1)

Table 1. Signs and symptoms at presentation (n = 50).

| Symptom | Number | Percentage |
|---|---|---|
| Ascites | 36 | 72% |
| Abdominal pain | 31 | 62% |
| Abdominal distention | 21 | 42% |
| Weight loss | 20 | 40% |
| Fever | 16 | 32% |

Anemia was present in 72% of patients with elevated ESR in 80%, Positive Mantoux test in 68% and positive GeneXpert in 30 % cases (Table 2)

## Table 2

Laboratory findings (n = 50).

| Parameter | Number | Percentage |
|---|---|---|
| Anemia | 36 | 72% |
| Elevated ESR | 40 | 80% |
| Positive Mantoux test | 34 | 68% |
| Positive GeneXpert | 15 | 30% |

Chest X-rays of 20 patients were consistent with pulmonary tuberculosis. Forty-one patients were assessed by abdominal ultrasound, and the most frequent findings were ascites, mesenteric lymphadenopathy, hepatic enlargement, splenic enlargement, and thickening of the intestinal loops (Table 3). Twenty-two patients underwent contrast-enhanced CT (CECT). The most common findings on abdominal computed tomography (CECT) were ascites, mesenteric lymphadenopathy (Figure 1), mesenteric thickening, omental thickening (Figure 2), thickening of the intestinal loops (Figure 3), hepatic enlargement, splenic enlargement, intra-abdominal mass, and pelvic mass (Table 4).

## Table 3

Abdominal ultrasound findings. Percentages are calculated among the 41 patients who underwent ultrasound.

| Finding | Number | Percentage |
|---|---|---|
| Ascites | 33 | 80.49% |
| Mesenteric lymphadenopathy | 12 | 29.3% |
| Hepatic enlargement | 8 | 19.5% |
| Splenic enlargement | 8 | 19.5% |
| Thickening of intestinal loops | 7 | 17% |


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## Table 4

Abdominal CT findings. Percentages are calculated among the 22 patients who underwent CT.

| Finding | Number | Percentage |
|---|---|---|
| Ascites | 11 | 50% |
| Mesenteric lymphadenopathy | 9 | 40.9% |
| Mesenteric thickening | 5 | 22.7% |
| Omental thickening | 4 | 18.2% |
| Thickening of intestinal loops | 4 | 18.2% |
| Hepatic enlargement | 3 | 13.6% |
| Splenic enlargement | 2 | 9% |
| Abdominal mass | 1 | 4.5% |
| Pelvic mass | 1 | 4.5% |

Pathological examination of specimens obtained during ultrasound-guided fine needle aspiration, biopsy (n=16) , laparotomy (n=6) and laparoscopy (n=3) revealed chronic granulomatous inflammation.



Figure 1. Axial contrast-enhanced CT (portal venous phase) of the abdomen in a 13-year-old patient demonstrates an enlarged right common iliac lymph node (black arrow), located anteromedial to the right common iliac vessels, with a few non-enhancing necrotic areas within.


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Figure 2. Axial contrast-enhanced CT (portal venous phase) of the abdomen in a 13-year-old patient demonstrates omental thickening with nodular soft tissue infiltration (omental caking; black arrow).



Figure 3. Axial contrast-enhanced CT (portal venous phase) of the pelvis in a 14-year-old patient demonstrates circumferential wall thickening of the terminal ileum (black arrow) with surrounding inflammatory changes.


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## Discussion

Abdominal tuberculosis (ATB) remains an important cause of chronic abdominal morbidity in children in endemic regions such as India, where delayed diagnosis continues to contribute to significant disease burden. The present study highlights the clinico-demographic profile and imaging spectrum of pediatric abdominal tuberculosis, emphasizing the role of radiologic evaluation in early diagnosis and disease characterization.

In the present cohort, peritoneal tuberculosis was the most common form, followed by intestinal involvement. This distribution is consistent with previous studies from endemic regions that report peritoneal involvement as the predominant manifestation in pediatric abdominal TB [4, 9, 10]. The nonspecific clinical presentation observed in this study—including abdominal pain, ascites, fever, and weight loss (Table 1)—closely mirrors earlier reports and contributes to frequent diagnostic delays due to overlap with inflammatory bowel disease, lymphoma, and other chronic intra-abdominal conditions [11].

## Differential Diagnosis

- Crohn's disease: Skip lesions, comb sign, absence of necrotic lymph nodes. - Lymphoma: Bulky homogeneous lymphadenopathy without central necrosis. - Peritoneal carcinomatosis: Irregular peritoneal nodularity without necrotic nodes.

Ultrasonography was the initial imaging modality in the majority of patients and demonstrated ascites and mesenteric lymphadenopathy as the most frequent findings (Table 3). These sonographic features, although not pathognomonic, are well-recognized indicators of abdominal tuberculosis when present in combination, particularly in endemic settings [12, 13]. Additional findings such as bowel wall thickening and hepatosplenomegaly further supported the diagnosis in appropriate clinical contexts.

Contrast-enhanced computed tomography (CT) provided superior anatomical delineation and comprehensive disease mapping. In this study, CT most commonly demonstrated ascites, necrotic mesenteric lymphadenopathy, mesenteric and omental thickening, and bowel loop involvement (Table 4). These imaging features have been consistently described as characteristic of abdominal tuberculosis and are helpful in differentiating it from Crohn's disease and intra-abdominal malignancies [14, 15, 16].

Despite advances in microbiological diagnostics, bacteriological confirmation remains challenging in pediatric abdominal tuberculosis due to the paucibacillary nature of the disease. In the present study, GeneXpert positivity was limited (Table 2), consistent with previously reported variable sensitivities in extrapulmonary tuberculosis [8]. Histopathological demonstration of granulomatous inflammation, although not universally present, remains an important diagnostic adjunct. Consequently, imaging assumes a central role in establishing the diagnosis when microbiological and histopathological results are inconclusive.

Based on the findings of this study and existing literature, a stepwise imaging-based diagnostic approach is advocated. Ultrasonography should be employed as the first-line imaging modality in suspected cases, followed by contrast-enhanced CT for detailed assessment of disease extent, complications, and guidance for tissue sampling. In patients with strong clinical suspicion and characteristic imaging findings, empirical anti-tubercular therapy may be justified even in the absence of microbiological confirmation, with close clinical and radiologic follow-up, as supported by current recommendations [17].

Ascites was reported among the clinical findings (Table 1) and on ultrasound and CT (Tables 3 and 4). Laboratory findings are summarized separately in Table 2. These observations are descriptive.

Pediatric-Specific Considerations: Children more commonly demonstrate prominent lymphadenopathy, disseminated involvement, and nonspecific symptoms. Ultrasound remains preferred first-line imaging due to radiation considerations. The limitations of this study include its retrospective design and relatively small sample size. Additionally, not all patients underwent both ultrasonography and CT, which may have limited direct comparison between modalities. Nevertheless, the study reinforces the indispensable role of imaging in the diagnostic evaluation of pediatric abdominal tuberculosis.

## Conclusion

This retrospective series describes the clinical and imaging findings of children diagnosed with abdominal tuberculosis. Imaging findings should be interpreted together with clinical, microbiological, and histopathological information. These descriptive data do not establish diagnostic accuracy, differences between diagnostic categories, or improved treatment outcomes.


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## Declarations

Consent for publication: The author clarifies that written informed consent was obtained and the anonymity of the patient was ensured. This study submitted to Swiss J. Rad. Nucl. Med. has been conducted in accordance with the Declaration of Helsinki and according to requirements of all applicable local and international standards. All authors contributed to the conception and design of the manuscript, participated in drafting and revising the content critically for important intellectual input, and approved the final version for publication. Each author agrees to be accountable for all aspects of the work, ensuring its accuracy and integrity.

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