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KEY WORDS: Abdominal tuberculosis, multi-detector computed tomography, MDCT, lymphadenopathy, peritoneal involvement, granulomas, histopathology.

TO ASSESS THE UTILITY OF MULTI-DETECTOR COMPUTED TOMOGRAPHY (MDCT) IN THE EVALUATION OF ABDOMINAL TUBERCULOSIS

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ABSTRACT

Introduction: Abdominal tuberculosis (TB) is a significant form of extrapulmonary TB, affecting the gastrointestinal tract, peritoneum, lymph nodes, and solid organs. Diagnosing abdominal TB is challenging due to its non-specific symptoms and overlap with other diseases. Multi-detector computed tomography (MDCT) offers valuable diagnostic insight into this condition. This study aimed to evaluate the effectiveness of MDCT in diagnosing abdominal TB and its role in managing this disease. **Material & Methods:** This analytical cross-sectional study included 50 patients with suspected abdominal TB who underwent contrast-enhanced computed tomography (CECT) at the Department of Radiodiagnosis, SAIMS & PG Institute, Indore. CT images were obtained, and findings such as lymphadenopathy, peritoneal involvement, ascites, pleural effusion, and solid organ involvement were analyzed. Histopathological examinations confirmed TB in a subset of patients. **Results:** The study included 50 subjects with a mean age of 29.68 ± 7.374 years, predominantly male (72%). Abdominal pain was present in all patients (100%), while fever and weight loss were reported in 76% and 58%, respectively. The most common CT findings included ascites (88%), necrotic lymph nodes (66%), and pleural effusion (12%). Histopathology confirmed tuberculosis in 22 subjects, with granulomas and caseous necrosis found in all positive cases. **Conclusion:** MDCT is a critical tool for diagnosing and managing abdominal tuberculosis, offering detailed imaging of affected areas. It is highly effective in identifying lymphadenopathy, peritoneal involvement, and complications such as bowel obstruction. Despite its limitations, including radiation exposure and diagnostic overlaps, MDCT remains an invaluable modality for early detection and treatment guidance in abdominal TB cases.

INTRODUCTION

Tuberculosis (TB) has long been a major cause of mortality among adults worldwide. While control efforts have gradually reduced its impact, there remains a strong correlation between a nation's development, infrastructure quality, and the effectiveness of TB control measures. Low- and middle-income countries, particularly India, which represents over 26% of the global TB burden, experience a significantly higher incidence of the disease. [1,2].

Extrapulmonary tuberculosis (EPTB), first documented in 1643, has become a significant concern, with about 15% of TB patients developing this form [3,4]. EPTB can affect multiple organs but is predominantly seen in the abdomen, often contracted through ingestion of infected sputum or close contact with infected individuals. The bacteria can reach the gastrointestinal (GI) tract through hematogenous spread, contaminated sputum, or direct extension from nearby lymph nodes. [5-7]

Abdominal tuberculosis can involve structures such as the gastrointestinal and genitourinary tracts, solid organs (e.g., liver, spleen, pancreas), gallbladder, peritoneum, and lymph nodes. [8,9] This condition can mimic other diseases, including inflammatory bowel disease, malignancies, and infections like lymphoma. Although imaging findings alone are not definitive, they can suggest EPTB when combined with clinical observations and patient demographics. [10]

Common symptoms of abdominal tuberculosis include fever (75%), abdominal pain (65%), and weight loss (36%). Tomographic findings often reveal peritonitis (38%), lymph node involvement (23%), gastrointestinal tract issues (19%), and complications in solid organs (10%).[11] Lymph node and gastrointestinal tract involvement, particularly in the terminal ileum and ileocecal region, is frequently observed. [8] Peritoneal tuberculosis is the most prevalent form, primarily resulting from hematogenous spread, but can also arise from lymph node rupture or gastrointestinal spread. [8,10,11]

Diagnosing abdominal tuberculosis is challenging due to varied clinical manifestations, nonspecific laboratory results, and imaging overlaps with other conditions. For instance, peritoneal tuberculosis may mimic carcinomatosis, while intestinal tuberculosis can be confused with Crohn's disease. [8]

Timely diagnosis is essential for initiating treatment and enhancing outcomes. [12] Recognizing self-resolving conditions also helps optimize healthcare resources. While conventional radiography, such as X-rays, has limitations, it can still detect bowel obstructions. In contrast, computed tomography (CT) offers superior diagnostic information, and the American College of Radiology recommends contrast-enhanced CT for patients presenting with fever and nonlocalized abdominal pain. [13,14]

CT scans have become vital in diagnosing acute non-traumatic abdominal pain due to their speed and accuracy. The two primary CT techniques are multidetector CT (MDCT) and dual-energy CT (DECT), which differ in their image acquisition methods. DECT measures attenuation at two energy levels, while MDCT employs single-tube potential switching for simultaneous data collection. [15,16] MDCT is preferred for patients with severe abdominal pain, providing rapid and detailed assessments of the gastrointestinal tract and other areas without interference from bowel gas.[13] Modern MDCT technology allows for comprehensive evaluations with sub-millimeter thickness. [17]

Despite achieving high diagnostic precision with sensitivity and specificity rates around 90-95%[18], there is no conclusive evidence that this accuracy leads to improved patient outcomes. CT scans pose risks, including contrast allergies, nephropathy, and exposure to ionizing radiation. [19,20] The increasing use of CT in emergency departments has highlighted that many scans do not reveal acute pathology. [21]

Given the diverse clinical and imaging presentations of tuberculosis, maintaining a high index of suspicion is vital for diagnosis. While biopsy and culture specimens are essential, prompt identification of imaging findings by radiologists is crucial for timely diagnosis and treatment. CT evaluation is considered the gold standard in acute scenarios due to its

accessibility and diagnostic accuracy. This study seeks to explore the effectiveness of multi-detector computed tomography in assessing abdominal tuberculosis.

MATERIAL AND METHODS

After approval from institutional ethical committee, this aanalytical cross-sectional study was conducted in the Department of Radiodiagnosis of SAIMS & PG Institute, Indore and 50 Patients of both sexes and all ages presenting with symptoms of abdominal tuberculosis referred to Department for CECT abdomen for evaluation of the tuberculosis on the basis of their CECT characteristics were evaluated. Patients qualifying the inclusion and exclusion criteria were enrolled after taking written informed consent from patients or patient's relatives.

Inclusion Criteria

- Patients of both sexes and all ages presenting with symptoms of abdominal tuberculosis, undergoing CT, during the study duration.
- Patient who gave consent for the study.

Exclusion Criteria

- Patients who did not gave consent for the study.
- Pregnant females.
- Patients with raised creatinine level.

Methodology

CT images were obtained with a Siemens 64 slice CECT scanner (Somatom Definition AS). Coronal and sagittal reformation of the images will be done using Maximal Intensity Projection (MIP), Multiplanar Reformation (MPR) and Volume Rendering Technique (VRT). The axial as well as reformatted coronal and sagittal images were evaluated. The Images were analyzed by experienced radiologist and relevant data was noted on pre-structured proforma for the study and statistically analysed. Histopathological examination was also conducted.

Statistical Analysis

The data was coded and entered into Microsoft excel 2010 (Microsoft corp.), analyzed using excel 2010 and SPSS 20.0 for Windows (SPSS inc). The results of the study were tabulated and statistically analyzed. Descriptive statistics was carried out to identify the characteristics and features of collected data. Mean and Percentage was used to represent the data. Chi square test was applied to identify the association between variable, P value < 0.05 will be considered statically significant. Sensitivity, Specificity, Positive predictive value, Negative predictive value was calculated.

RESULTS

Clinicodemographic Profile: The present study included 50 subjects with a clinical diagnosis of Tuberculosis. The mean age of the subjects was 29.68 ± 7.374 years (range 15 to 48 years). Majority of patients belonged to 21-30 years age group followed by 31-40 years. There was a greater number of males than females [72% vs. 28%] with M:F ratio of 2.6:1. Pain was the universal complaint present in all subjects (100.0%). Fever and weight loss were reported by 76.0% and 58.0% respectively. All the subjects presented with more than one complaint.

Table 1. Distribution Of Study Subjects Based On Clinicodemographic Parameters

	No. of subjects (N=50)	%
Age group		
≤20 years	7	14.0
21- 30 years	22	44.0
31- 40 years	18	36.0
41- 50 years	3	6.0
Gender		
Male	36	72.0
Female	14	28.0
Presenting complaints		
Pain	50	100.0
Fever	38	76.0
Weight loss	29	58.0

CT Findings: The CT findings from the study revealed several key aspects of abdominal tuberculosis. Involvement of the small intestine and ileocecal junction was observed in all subjects, with bowel perforation noted in 4% of cases. Omental involvement was seen in only 4% of patients, while the majority (96%) showed no omental involvement. Necrotic lymph nodes were present in 66% of subjects, with 26% exhibiting benign lymph node changes and 8% showing no lymph node involvement. Ascites was a prominent finding, detected in 88% of patients, while pleural effusion occurred in 12% of cases. Lastly, there was no significant solid organ involvement, as reflected in the 66% of patients with necrotic lymph nodes and 8% with benign changes. Overall, the findings highlight the importance of CT imaging in diagnosing and assessing the extent of abdominal tuberculosis.

Table 2. Distribution Of Study Subjects Based On CT Findings.

CT findings		No. of subjects	%
Bowel			
Involvement of	Small intestine	50	100.0
	Ileocecal junction	50	100.0
	Large intestine	0	0.00
Presence of	Bowel perforation	2	4.0
Omentum			
Involved		2	4.0
Not involved		48	96.0
Lymph node			
Necrotic		33	66.0
Benign		13	26.0
No involvement		4	8.0
Presence of ascites			
Yes		44	88.0
No		6	12.0
Presence of pleural effusion			
Yes		6	12.0
No		44	88.0
Solid Organ			
Involvement of	Adnexa	4	8.0
	Liver	0	0.0
	Kidney	0	0.0
	Spleen	0	0.0

Histopathological findings: Histopathology revealed 22 subjects to be positive for tuberculosis. Out of 22, granuloma and caseous necrosis were present in all subjects. Thirteen subjects (26.0%) had conglomerated epithelioid histiocytes and 4 (8.0%) subjects showed disproportionate submucosal inflammation.

Table 3. Distribution Of Study Subjects Based On Histopathological Findings.

Histopathological finding		No. of subjects	%
Positive (n=22)	Granuloma	22	44.0
	Caseous necrosis	22	44.0
	Conglomerated epithelioid histiocytes	13	26.0
	Disproportionate submucosal inflammation	4	8.0
Negative		28	56.0

DISCUSSION

Pulmonary tuberculosis (TB) remains the primary focus of diagnosis and treatment, while extrapulmonary tuberculosis (EPTB), despite its significant impact, often receives less

attention. Radiological imaging plays a key role in detecting abdominal TB, particularly through abdominal ultrasound and CT scans. Common CT findings include peritoneal involvement, free or encapsulated ascites, and high-attenuation fluid due to its protein-rich content. Peritoneal thickening and nodular enhancement are frequently observed, with lymphadenopathy being the most common radiologic indicator. [22-24]

Early diagnosis and strict adherence to treatment are essential for effective recovery. However, EPTB is often misdiagnosed as inflammatory bowel disease, malignancy, or other infectious diseases due to its varied symptoms. [25] Abdominal TB can affect several structures, including the gastrointestinal and genitourinary tracts, solid organs like the liver and spleen, and lymph nodes. The condition may resemble adenocarcinoma, Crohn's disease, or lymphoma, making imaging findings alone insufficient for diagnosis. However, when combined with clinical and immunological assessments, imaging can strongly suggest EPTB. [26]

The study included 50 clinically suspected tuberculosis cases (mean age: 29.68 years, range 15-48; 72% males), evaluated using contrast-enhanced computed tomography (CECT) and histopathological assessments like FNAC/biopsy. These results align with previous studies by Khan A et al., Mir AT et al., and Sharma B et al., which reported similar age ranges and a predominance of male patients. [1,27,28]

In the present study, Abdominal pain was observed as a universal symptom (100%) among patients, with fever (76%) and weight loss (58%) also commonly reported. These results are consistent with other studies by Mir AT et al. [27], Sharma B et al. [28] and Shimy et al. [29], and., which similarly observed abdominal pain, fever, and weight loss as frequent symptoms in tuberculosis cases.

CT scans in the study revealed that ascites was the most common finding, present in 88% of patients, followed by necrotic lymph nodes in 66%. This aligns with Mir AT et al.'s findings, where ascites (72.7%) and mesenteric lymphadenopathy (40.9%) were prevalent. [27] Similarly, Sharma B et al. reported ascites in 34.6% of cases, along with mesenteric lymphadenopathy (47.4%) and other signs such as mural wall thickening. [28] Flores et al. also observed peritoneal thickening in 83% of patients and mesenteric lymphadenopathy in 50%. [30]

In this study, pleural effusion was observed in 12% of patients, aligning with findings from Sharma B et al. [28] The ileocecal junction was the most common site of intestinal involvement, with all patients showing small intestine and ileocecal involvement, and 4% experiencing bowel perforation. This mirrors results from studies by Sharma B et al. [28], Kumar et al. [31], and Urabinahatti et al. [32], where similar patterns of intestinal involvement were noted.

Ascites was the most frequent finding, present in 88% of patients, consistent with Mir AT et al. [27] (72.7%) and Sharma B et al. [28] (34.6%). Omental involvement was rare, observed in only 4% of cases. Lymphadenopathy was present in 66% of patients, with necrotic lymph nodes being the most common type. This finding is consistent with Mir AT et al. [27], who reported mesenteric and retroperitoneal lymphadenopathy in 40.9% and 30.4% of patients, respectively.

Solid organ involvement was minimal, with adnexal involvement in 8% of patients, while no liver, kidney, or spleen involvement was noted. In contrast, Mir AT et al. reported visceral involvement in some patients, including liver and tubo-ovarian masses. [27]

Histopathological analysis confirmed tuberculosis in 22 subjects, with all cases showing granuloma and caseous necrosis. Among these, 26% exhibited conglomerated epithelioid histiocytes, and 8% demonstrated disproportionate submucosal inflammation.

The study's findings suggest that contrast-enhanced CT of the abdomen is a highly accurate and effective diagnostic tool for suspected cases of abdominal tuberculosis. Its affordability and widespread availability make it a valuable resource for early diagnosis, helping to reduce delays in treatment initiation.

However, the study had certain limitations, including a small sample size, being conducted at a single center, and a patient population predominantly from a lower socioeconomic background. These factors may affect the generalizability of the results.

CONCLUSION

In conclusion, multi-detector computed tomography (MDCT) is a crucial imaging tool for diagnosing and managing abdominal tuberculosis. Its detailed anatomical imaging helps in identifying key features such as lymphadenopathy, peritoneal involvement, and granulomas in solid organs. MDCT is also instrumental in detecting complications like bowel obstruction or abscess formation, differentiating abdominal TB from other similar conditions, and monitoring the response to anti-tubercular treatment. Despite challenges like overlapping features with other diseases and radiation risks, MDCT remains invaluable in guiding accurate diagnosis and clinical management of abdominal TB.

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