

Diagnostic Utility of Computed Tomography Entero graphy in Differentiation of Early Ileocecal Tuberculosis from Early Crohn’s Disease.

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Abstract

Background: Ileocecal tuberculosis (ITB) and Crohn’s disease (CD) are chronic inflammatory bowel disorders that are frequently misdiagnosed due to overlapping clinical, radiologic, endoscopic, and histologic resemblance.

Aims and Objectives: To evaluate the role of CT-entero graphy in differentiation of early ileocecal tuberculosis from early Crohn’s disease.

Material and methods: This study was a prospective hospital based observational study conducted over a period of 30 months.

Results: A total of 153 patients were studied. A statistically significant difference was found between the type of thickening, type of enhancement, presence of ascites, presence of comb sign, presence of skip lesions and presence of necrotic nodes between the Crohn’s disease and ileocecal tuberculosis. CT entero graphy had a sensitivity of 78.65%, Specificity of 69.19, Positive pre

dictive value of 76.92% and diagnostic accuracy of 73.86 % for Crohn’s Disease. CT entero graphy had a sensitivity of 75.00%, Specificity of 87.61%, Positive predictive value of 68.18% and diagnostic accuracy of 84.31% for ileocecal tuberculosis.

Conclusion: Computed Tomography Entero graphy can be used as an aid to differentiate between early ileocecal tuberculosis and early Crohn’s disease.

Keywords: CT Entero graphy, Tuberculosis, Crohn’s Disease, Ileocecal region

Introduction

A change in the epidemiology of inflammatory bowel diseases has been noted recently with previously low incidence regions now reporting a continuous rise in incidence. The rising incidence of Crohn’s Disease in countries such as India where Tuberculosis continues to be endemic has made the differentiation of these two disorders a diagnostic challenge.¹

Ileocecal tuberculosis and Crohn's disease usually present with overlapping clinical presentation. The clinical symptomatology and even endoscopy cannot reliably differentiate between the two entities.²

Traditionally, barium studies were used to evaluate bowel lesions; however, they failed to demonstrate extra luminal findings.² Nowadays, computed Tomography (CTE) using neutral oral contrast media is the investigation of choice for patients with suspected ITB or CD. CTE provides good bowel distention, which helps in disease localization and assessment of various patterns of bowel wall enhancement and demonstrates the extraintestinal findings.^{3,4}

The definitive diagnosis of Intestinal/ ileocecal Tuberculosis or Crohn's Disease is usually made by correlating CTE findings with endoscopy, histopathology, or clinical/ endoscopic improvement with empirical therapy.⁵

Endoscopy usually demonstrates transverse ulcers and a patulous ileocecal valve in ITB and mucosal cobblestoning and linear ulcers in Crohn's Disease.^{5,6} Histopathology shows caseating granulomas and acid-fast bacilli in intestinal tuberculosis and fissuring ulcers and transmural inflammation in Crohn's Disease⁷. However, in practice, such a classical picture of these diseases on imaging, endoscopy, or histopathology is rarely observed and more often than not, an overlap of the various findings exists.

The disease course of ileocecal tuberculosis is very different from that of Crohn's disease. Ileocecal tuberculosis can be completely cured if an early diagnosis and proper treatment is provided. On the other hand, Crohn's Disease is prone to recurrences, which highlights the importance of making accurate diagnosis at the earliest possible stage.

The present study was aimed to study the role of CT enterography in differentiation of early Crohn's disease from early ileocecal tuberculosis.

Material and Methods

Study Design

This was a hospital based observational study conducted for a period of two and half years 1st July 2020 to 31st December 2022 after obtaining ethical clearance from institutional ethical committee.

Study Sample

Study group consisted of all consecutive patients who presented with new onset lower gastro intestinal symptoms (altered bowel habits, blood with stools, unexplained abdominal pain, mucus with stools etc.) and ileocecal mucosal lesions of uncertain diagnosis on colonoscopy. The patients were subjected to colonoscopy and those patients who had ileocecal mucosal lesions of uncertain diagnosis on colonoscopy were included in the final cohort.

Inclusion criteria

1. Age >18 years
2. New onset lower gastro intestinal symptoms of < 3 months.
3. Ileocecal lesions of uncertain diagnosis on colonoscopy as evidenced by the presence of inflammation, ulceration or nodules.

Exclusion criteria

1. Patients with Prior intestinal resection
2. Patients with Stage 4 or 5 chronic kidney disease i.e a glomerular filtration rate of ≤ 30 ml/ min.
3. Patients with any contraindication to CT scan (e, g pregnancy) or to CT contrast agent (Prior history of Allergic reaction to iodinated contrast material, Chronic Renal failure).
4. Patient with history of prior ATT or immunomodulatory (anti-TNF) treatment.

Diagnostic Criteria

The following CT entero graphy findings were noted for diagnosis of Crohn's disease and ileocecal tuber culosis

Crohn's disease

- Symmetrical Wall Thickening
- Stratified Hyperenhancement
- Comb Sign
- Skip Lesions
- Terminal ileum predominance
- Small enhancing nodes

Ileocecal tuberculosis

- Asymmetric Wall thickening
- Homogenous enhancement
- Ascitis
- Large Lymph nodes with necrosis
- Ileocecal junction/Cecal predominance

Indeterminate

Patients which had CT entero graphy features with some resembling Crohn's disease and others resembling ileo cecal tuberculosis were labeled as indeterminate.

Study procedure

A detailed history was elicited from all patients followed by clinical examination and relevant laboratory investigations as per annexed Performa prior to imaging procedure. Informed and written consent was taken from all the patients prior to procedure.

Imaging technique and protocol

All patients were prepared with a 24-hour residue free liquid diet and complete fasting 4 hours before the study.

All the CT entero graphy scans were performed with helical CT scanner - siemens Somatom definition flash, 256 slice.

A single breath-hold scan was obtained from the diaphragm to the symphysis pubis with a section thickness of 2 to 2.5 mm and a reconstruction interval of 1.0

to 1.5 mm. Both non enhanced and contrast enhanced scans were performed.

Technical scan parameters used will be as follows

- Scan area: Diaphragm to pubic symphysis
- Scan direction: Cranio-Caudal
- Tube Voltage:120kV
- Rotation Time:0.5s
- Pitch :0.6
- Slice width:2mm
- Interval reconstruction:<2mm

Bowel Distending Contrast Agent

1.35 litres of 3% mannitol solution with was used as bowel distending neutral per oral contrast agent over one hour (450 ml at 60 minutes,450 ml at 50 minutes, 225 ml at 20 minutes and 225 ml at 10 minutes before scanning). 60 minutes prior to CT entero graphy 10 mg of oral metoclo pramide was given in order to increase gastric and small bowel peristalsis. 10 mg of hyoscine-N butyl bromide was administered to the patient just before scanning.

Intravenous Contrast

Non-ionic iodinated contrast material (Ultravist, 300 mg/ml, {Iopromide} 1.5 ml/kg of body weight injected at the rate of 2.5 ml per second was given. Images were obtained using multidetector row CT scanners beginning approximately 45 seconds after the initiation of contrast material injection.

Image Analysis

CT images were read/analysed by an experienced radiologist who has greater than ten years of experience in abdominal imaging. The focus of image analysis was on CT parameters including location in bowel, location within wall, mural enhancement, mural stratification, length of involvement, degree of thickening, type of thickening, mucosal folds, sub mucosal fat deposition, pseudo sacculation, ileocaecal junction involvement,

mesenteric vascular prominence (Comb sign), mesenteric fat stranding, mesenteric fibrofatty proliferation, increased peri enteric fat attenuation, mural attenuation value, abnormal to normal loop enhancement ratio, omental and mesenteric thickening, presence of stricture, fistula, lymphadenopathy and ascites.

Statistical Analysis

Data was entered into a Microsoft excel spreadsheet. Categorical variables were summarised in terms of frequencies and percentages. The sensitivity, specificity, positive predictive value, negative predictive value and

diagnostic accuracy were calculated. Diagnostic accuracy and validity was calculated using Open Epi.

Results

A total of 178 cases were included out of which 25 cases were lost during follow up during the course of study. A total of 153 cases were studied for different parameters.

Clinical features and Demographics

In this study, no significant difference was found in demographic characteristics. Symptoms of abdominal pain and altered bowel habits were found to be commoner. However, no symptom was found to be specific for either ileocecal tuberculosis or Crohn’s disease. (Table 1)

Table 1: Demographic parameters and clinical presentation of patients of Crohn’s disease and ileocecal tuberculosis

Sn.	Parameter	Crohn’s Disease(n=89)	Ileocecal Tuberculosis(n=40)	P value
1.	Demographics			
a.	Gender (Male: Female ratio)	1.68:1	1.79:1	0.27
b.	Mean age (age range) in years	45 (18-60)	43 (21-65)	0.439
2.	Symptoms			
a.	Abdominal pain	82(92.13%)	37(92.5%)	0.149
b.	Altered bowel habits	85(95.50%)	38(97.4%)	0.86
c.	Blood with stools	26(29.2%)	13(32.5%)	0.33
d.	Loss of appetite	25(28.08)	10(20.0%)	0.15
e.	Weight loss	4(4.44%)	5(12.5%)	0.437
f.	Nausea/vomiting	4(4.49%)	2(5.0%)	0.432
g.	Fever	6(6.7%)	7(17.5%)	0.213
h.	Night sweats	3(3.33%)	5(12.5%)	0.987

Final diagnosis in patients undergoing CT Enterography

It was observed that out of 91 cases who were given an CT enterography impression of Crohn’s disease, a total of 70 cases turned out to be Crohn’s on his to pathological examination. Further 5 cases were confirmed as ileocecal tuberculosis, 8 cases were confirmed as infectious ileitis and while as 8 cases were indeterminate on his to pathological examination.

Out of 44 cases who were given an CT enterography impression of ileocaecal tuberculosis, 30 cases turned out to be ileocecal tuberculosis on his to pathology while as 8 cases were confirmed as Crohn’s disease, 2 cases were confirmed as infectious ileitis and 4 cases were indeterminate on his to pathological examination.

A total of 12 cases who were given indeterminate CT enterography impression, 7 turned out to be Crohn’s disease, 2 cases were diagnosed as ileocecal tuberculosis

and two cases were indeterminate on histopathological examination.

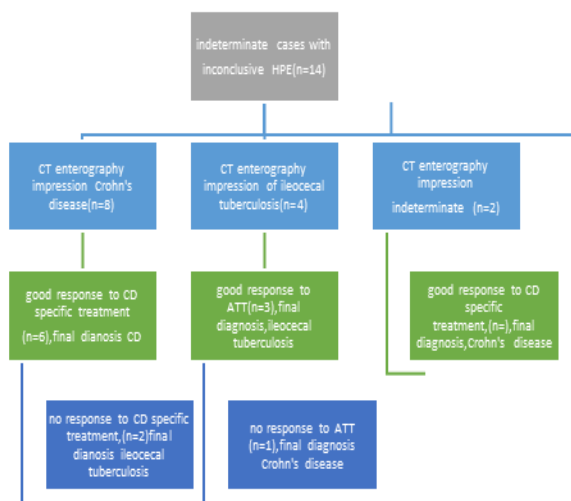
A total of six cases was given an unremarkable impression on CT enterography, out of which 4 cases

turned out to be Crohn's disease and two cases were confirmed as ileocecal tuberculosis on his to patho logical examination. (Table 2)

Table 2: Showing CT enterography and Final diagnosis of the Cases.

CT enterography impression	Final diagnosis (Histopathology)			
	Crohn's Disease	Ileocecal Tuberculosis	Infective ileitis	Indeterminate
Crohn's Disease(n=91)	70	5	8	8
Ileocecal Tuberculosis(n=44)	8	30	2	4
Indeterminate(n=12)	7	3	X	2
Unremarkable (n=6)	4	2	X	X
Total Case(n=153)	89	40	10	14

Flowchart showing fate of cases with indeterminate diagnosis on histopathology



Comparison of CT entero graphy findings between Crohn's disease and Ileo cecal tuber culosis

A statistically significant difference was found between the type of thickening, type of enhance ment, presence of ascites, presence of combs sign, presence of skip lesions and presence of necrotic nodes between the Crohn's disease and ileocecal tuber culosis. (Table 3)

Table 3: Comparison of CT entero graphy findings between Crohn's disease and Ileo cecal tuber culosis

Sn.	CT entero graphy Features	Crohn's Disease (n=89)	Ileocecal Tuberculosis (n=40)	P Value
1.	Incidence of Bowel Wall thickening	79(88.7%)	36(90.00%)	0.831
i.	Symmetrical wall thickening	84(94.38%)	5(12.5%)	<0.001

Bowel wall thickening was noted in 79/89 (88.7%) patients of Crohn's disease and 36/40 (90.00%) patients of Crohn's disease on CT - entero graphy.

Homo genous enhancement pattern of bowel wall thick ening was significantly commoner in cases of intestinal tuberculosis (74.41% cases) when compared to Crohn's disease (41.17% cases).

Increased mesenteric vascularity (Comb sign) was significantly more common in Crohn's disease (79.7% cases) when compared with intestinal tuber culosis (10.00% cases). Ascites was seen in 25 cases of intestinal tuber culosis and 4 case of Crohn's disease.

Skip lesions were significantly more common in Crohn's disease when compared to intestinal tuberculosis.

Lym phadeno pathy was found to be in ileocecal tuber culosis (70.0%) when compared to Crohn's disease (35.95%) Of ileocecal tuberculosis patients, 19 had necrotic lymph nodes. Necrotic lymphadeno pathy was not ob served in cases of Crohn's disease.

ii.	Asymmetric wall thickening	4(4.49%)	35(87.5%)	<0.001
2.	Pattern of bowel enhancement			
i.	Homogenous enhancement	4(4.49%)	32(80.00%)	<0.001
ii.	Stratified Hyperenhancement	83(93.25%)	1(2.5%)	<0.001
3	Ascites	4(4.49%)	25(62.5%)	<0.001
4	Combs sign	71(79.77%)	4(10.00%)	<0.001
5	Skip lesions	63(70.78%)	7(17.5)	<0.001
6	Lymphadenopathy	32(35.95%)	28(70.00%)	0.732
7	Lymph nodes with necrosis (n=28)	0(0.0%)	19(67.85%)	<0.001

Sensitivity, Specificity, PPV and Diagnostic accuracy of CT Entero graphy for Crohn’s Disease

diagnostic accuracy of 73.86 % for Crohn’s Disease (Table 4)

CT entero graphy had a sensitivity of 78.65%, Specificity of 69.19%, Positive predictive value of 76.92% and

Table 4: Sensitivity, Specificity, PPV and Diagnostic accuracy

	Sensitivity	Specificity	Positive predictive value	Diagnostic accuracy
Crohn’s Disease	78.65%	67.19%	76.92%	73.86%

Sensitivity, Specificity, PPV and Diagnostic accuracy of CT entero graphy for ileocecal Tuberculosis

diagnostic accuracy of 84.31% for ileocecal tuberculosis. (Table 5)

CT entero graphy had a sensitivity of 75.00%, Specificity of 87.61%, Positive predictive value of 68.18% and diag

Table 5: Sensitivity, Specificity, PPV and Diagnostic accuracy

	Sensitivity	Specificity	Positive predictive value	Diagnostic accuracy
Ileocecal tuberculosis	75.00%	87.61%	68.18%	84.31%

Sensitivity, Positive predictive value and diagnostic accuracy of various findings in Crohn’s Disease

Symmetrical wall thickening had a sensitivity of 94.38%, positive predictive value of 95.00% and diagnostic accuracy of 78.08% for Crohn’s disease.

Stratified hyper enhancement had a sensitivity of 93.25%, positive predictive value of 98.53% and diagnostic accuracy of 94.37% for Crohn’s disease.

Comb sign had a sensitivity of 79.77%, positive predictive value of 96.43% and diagnostic accuracy of 75.00% for Crohn’s disease.

Skip lesions had a sensitivity of 70.78%, positive predictive value of 90.57% and diagnostic accuracy of 64.00% for Crohn’s disease. (Table 6)

Table 6: Sensitivity, Positive predictive value and diagnostic accuracy of various findings in Crohn's Disease

Feature	Sensitivity	Positive predictive Value	Diagnostic accuracy
Symmetrical wall thickening	94.38%	95.00%	78.1%
Stratified Hyperenhancement	93.25%,	98.54%	94.4%
Combs sign	79.77%,	96.44%	75.1%
Skip lesions	70.78%,	90.58%	64.1%

Sensitivity, Positive predictive value and diagnostic accuracy of various findings in ileocecal tuberculosis

Asymmetric wall thickening had a sensitivity of 87.5%, positive predictive value of 70.37% and diagnostic accuracy of 63.33% for ileocecal tuberculosis.

Ascites had a sensitivity of 62.5%, positive predictive value of 88.24% and diagnostic accuracy of 57.69% for ileocecal tuberculosis.

Table 7: Sensitivity, Positive predictive value and diagnostic accuracy of various findings in ileocecal tuberculosis

Feature	Sensitivity	Positive predictive value	Diagnostic accuracy
Asymmetric wall thickening	87.5%	70.37%	63.33%
Ascites	62.5%	88.24%	57.69%
Lymph nodes with necrosis	67.85%	100.0%	67.85%

Discussion

This study evaluated the role of CT-EG in the differentiation of ileocecal tuberculosis from Crohn's Disease. CT - Enterography are appropriate diagnostic tests when ileocecal tuberculosis or Crohn's disease is suspected because they can assess bowel changes, the mesentery, abdominal lymph nodes, and other abdominal organs.

In our study no symptom was found to be specific to either ileocecal tuberculosis or Crohn's disease as was observed in other previous studies.^{8,9}

In this study, mural stratification pattern of enhancement of bowel wall thickening, skip lesions, and increased mesenteric vascularity (comb sign) were significantly more common in Crohn's Disease. Similar to the findings of Kedia et al.⁸ Kalra N, et al (2014)¹⁰ found homogenous mural enhancement to be the commonest pattern in

Lymph nodes with necrosis had a sensitivity of 68.75%, positive predictive value of 100.00% and diagnostic accuracy of 68.75% for ileocecal tuberculosis. (Table 7)

intestinal tuberculosis while Choi D, et al (2003)¹¹ found mural stratification pattern of enhancement of bowel wall thickening to be the commonest pattern in Crohn's disease. Zhao XS, et al (2014) did not find any significant difference in patterns of bowel wall enhancement between intestinal tuberculosis and Crohn's disease.⁹

In this study, the sensitivity of CT-Enterography for detecting ileocecal tuberculosis and Crohn's disease was 75.00% and 76.92% respectively. Ray D, et al (2013) observed a sensitivity of 93.75% for CT-EC in diagnosing small bowel tuberculosis.¹⁰ Previous studies have demonstrated a sensitivity of more than 85% for CT-EC/CT-EG in detecting Crohn's disease.¹¹

Features of Crohn's disease

Mural hyperenhancement

In our study, all the patients with Crohn's disease had mural hyper enhancement.

Stratified hyper enhancement had a sensitivity of 93.25%, positive predictive value of 98.54% and diagnostic accuracy of 94.4% for Crohn's disease in our study.

As per a study by Booya F et al (2006)¹⁴, mural hyper enhancement is the most sensitive sign of active Crohn's disease and is indicative of the disease activity. It is present in up to 82% of patients. Rasha Mostafa et al (2021)¹⁵ observed that mucosal hyper-enhancement was seen in 88% cases studied.

Skip Lesions

In our study Skip lesions were seen in 70.78% (n=63) cases. Skip lesions had a sensitivity of 70.78%, positive predictive value of 90.57% and diagnostic accuracy of 64.00% for Crohn's disease in our study. In a study conducted by Rasha Mostafa et al (2021)¹⁵ skip lesions were observed in 12 (24%) patients out of 50 cases studied.

Comb sign

In our study, Comb sign was evident in the mesentery in 79.77% (n=71) cases of Crohn's disease. Comb sign had a sensitivity of 79.77%, positive predictive value of 96.4% and diagnostic accuracy of 75.1% for Crohn's disease in our study.

According to Lee et al (2002)¹⁶ increased attenuation of mesenteric fat in combination with comb's sign is the most specific CT finding for active Crohn's disease.

Rasha Mostafa et al (2021)¹⁵ observed that engorgement of vasa recta (comb sign) was seen in 38 patients (76%) out of 50 patients.

Features Ileocecal Tuberculosis Wall thickening

In our study, symmetric thickening was seen in 13.63% (n=3) cases and asymmetric thickening in 87.5% cases (n=35). Asymmetric wall thickening had a sensitivity of

87.5%, positive predictive value of 70.37% and diagnostic accuracy of 63.33% for ileocecal tuberculosis. These findings correlate with the findings in a study by Balthazar et al (1990)¹⁷

Ascites

A total of 62.5% cases of tuberculosis had ascites (n=25). In our study Ascites had a sensitivity of 62.5%, positive predictive value of 88.24% and diagnostic accuracy of 57.69% for ileocecal tuberculosis. In a study by Misra RN et al (2019)¹⁸, ascites was evident in 8 out of 30 patients. This hyperdense ascites is due to the fact that fluid contains proteinaceous contents and fibrin in TB.

Lymphadenopathy

In our study, 70% cases (n=28) revealed associated lymphadenopathy.

Lymph nodes with necrosis had a sensitivity of 68.75%, positive predictive value of 100.00% and diagnostic accuracy of 68.75% for ileocecal tuberculosis in our study.

In Emil J Balthazar et al (1990)¹⁷ study, lymph nodes in ileocaecal TB had a homogeneous soft-tissue appearance in five patients or exhibited central areas of low density presumed to correspond to caseous liquefaction in four patients. In a study by Misra RN et al (2019)¹⁸, seven patients with findings of abdominal tuberculosis underwent FNAC from lymph node, out of which 6 patients were confirmed to be tubercular.

Conclusion

CT Enterography is sensitive investigation for the detection of the bowel lesions in ileocecal tuberculosis and Crohn's disease and can serve as investigation of choice for differentiating early Crohn's disease from early ileocecal tuberculosis.

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