Citation: Clinical and Translational Gastroenterology (2012) 3, e24, doi:10.1038/ctg.2012.19

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Colon Tuberculosis: Endoscopic Features and Prospective Endoscopic Follow-Up After Anti-Tuberculosis Treatment

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OBJECTIVES: Tuberculosis (TB) is still common in many countries and there has been a resurgence of TB in the developed nations. Although small bowel is the most commonly affected gastrointestinal organ, increasing numbers of cases are being described with colon TB. There are limited prospective studies looking at the outcomes of colon lesions, especially after anti-TB treatment. Our aim was to evaluate the endoscopic features of TB of the colon and to prospectively follow up the endoscopic response of colon lesions to anti-TB treatment.

METHODS: From October 2004 to December 2010 consecutive patients presenting with colon TB to one tertiary care center in India were enrolled. Demographic, clinical data, and lesions identified on colonoscopy were recorded. Anti-TB treatment was started and follow-up colonoscopy was performed within 4 weeks after completion of anti-TB treatment. Post-treatment endoscopic features and clinical outcomes were noted.

RESULTS: Sixty-nine consecutive patients with colon TB were enrolled (mean age 39.3 ± 14.8 years; male 45, female 24). Presenting clinical features included abdominal pain 80.6%, weight loss 74.6%, fever 40.3%, diarrhea/constipation 25.4%, diarrhea 16.4%, blood per rectum 11.9%, abdominal tenderness 37.3%, abdominal mass 13.4%, and lymphadenopathy 1.5%. Macroscopic lesions on endoscopy were predominantly right-sided (cecum and ascending colon) and primarily ulcers (ulcers 88.0%, nodules 50.7%, luminal narrowing 44.8%, polypoid lesion 10.4%). Majority of the ulcers (87.2%), nodules (84.6%), polypoid lesions (85.7%), luminal narrowing (76.2%), and ileo-cecal valve deformities (76.5%) resolved with anti-TB treatment.

CONCLUSIONS: TB of the colon predominantly affects the cecum and the ascending colon. Ulceration, nodularity, and stricture are the prominent endoscopic findings. Majority of the lesions heal with anti-TB treatment.

Clinical and Translational Gastroenterology (2012) **3,** e24; doi:10.1038/ctg.2012.19; published online 11 October 2012
Subject Category: Colon/Small bowel

INTRODUCTION

Mycobacterium tuberculosis (TB) infection is still common in many countries. According to a World Health Organization report, global annual incidence of TB is estimated to be 9.4 million cases, of which 1.98 million cases are from India,[1] and close to 500,000 per year will die of the disease in India.[2] There has also been a resurgence of TB in many developed countries secondary to migrant population, deteriorating social conditions, cutbacks in public health services and increasing prevalence of immuno-suppressed individuals.[3–9] In one study, coinfection of TB and HIV was reported to be as high as 73%.[6] TB is also a major concern in those receiving biological agents for conditions like rheumatoid arthritis or inflammatory bowel disease.[3,10] Immuno-suppressants given on the mistaken diagnosis of inflammatory bowel disease can result in systemic spread of TB with fatal consequences.

Although TB of the gastrointestinal tract is not as common as pulmonary TB, terminal ileum is the most frequently affected organ. This is attributed to the high prevalence of lymphoid tissue in the terminal ileum and a longer contact time of luminal contents with the small bowel. Ulcerations and luminal narrowing are the predominant lesions found in this region of the small bowel. Besides the terminal ileum, several small case series have described TB affecting the colon.[11–21] TB of the colon is rare and hence it can be misdiagnosed as colon cancer, inflammatory bowel diseases, ischemic colitis or infectious colitis (also endemic in areas with high prevalence of TB).

In view of the anatomic (lymphoid tissue) and physiological (contact time with luminal contents) differences between the small bowel and the colon, the resolution pattern of lesions in the colon after anti-TB treatment is not well known as routine colonoscopy is not performed after completion of treatment. The aim of the present study was to evaluate the endoscopic features of TB of the colon and prospectively evaluate the healing of TB lesions after anti-TB treatment.

METHODS

We conducted a prospective cohort study enrolling consecutive patients diagnosed with colon TB from October 2004 to

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Part of this work was presented at the Digestive Disease Week, 2007.
Received 9 March 2012; revised 26 June 2012; accepted 30 July 2012

December 2010 at one tertiary care center in India. Informed consent was obtained from all the patients. The study was approved by the local Institutional Review Board.

Patients $\geq$18 years of age who were suspected or confirmed to have colon TB based on clinical evaluation and endoscopic biopsies were enrolled. Those with ulcerative colitis, Crohn's disease, microscopic colitis, or indeterminate colitis were excluded. Patients presenting with symptoms suggestive of colitis such as bloody diarrhea, abdominal pain, and fever routinely underwent stool studies, and where indicated additional tests were performed to rule out infectious etiology like salmonellosis, shigellosis, and amebiasis.

Demographic information, clinical history and physical examination findings were noted. Information collected included previous history of TB, history of TB in close contacts, history of HIV, the presence or absence of abdominal pain, fever, bleeding per rectum, weight loss, loss of appetite and altered bowel movements. Clinical examination findings including vitals, pallor, abdominal tenderness, abdominal mass and lymphadenopathy were recorded. Results of routine laboratory tests were also noted. Medication list was reviewed for immunosuppressive agents. Additional investigations including chest X-ray, abdominal ultrasound and abdominal computerized tomography scan were done when clinically indicated.

Colonoscopy and biopsies. All subjects underwent colonoscopy and were evaluated for lesions in the colon and terminal ileum. Location of lesion was identified as present/absent in the terminal ileum, cecum, ascending colon, transverse colon, descending colon, sigmoid colon, and/or rectum. The type of lesion was recorded as ulcers, nodules, polypoidal and/or luminal narrowing. When a lesion was identified, a minimum of six biopsy samples were obtained (from the edges and bed of the lesion). Biopsy samples were stained with hematoxylin/eosin and Ziehl/Nielsen. The precise location of the lesion was documented (centimeters from the external anal sphincter during withdrawal of the endoscope) and multiple pictures were taken before biopsying the lesion. The luminal diameter of strictures was assessed in comparison with the diameter of the endoscope used or relative to an open-biopsy forceps. Patients diagnosed to have colon TB were then given anti-TB treatment and a repeat colonoscopy was performed within 4 weeks of completing the treatment. Biopsy samples were obtained in a similar manner when a lesion was identified on repeat colonoscopy.

Diagnosis of colon TB. Initial diagnosis of ''confirmed colon TB'' was made if the biopsy specimen showed caseating granulomas and/or acid-fast bacilli. Initial diagnosis of ''suspected colon TB'' was made in patients on clinical grounds: pyrexia of unknown origin, weight loss, anemia, active or previous pulmonary TB, history of TB in close contacts and biopsy showing non-caseating granuloma and chronic inflammation. Although patients with non-caseating granulomas could have inflammatory bowel disease, empiric immuno-suppressive therapy was avoided and anti-TB treatment was started as all patients came from areas endemic for TB. Diagnosis of colon TB was made by assessing response to treatment as per Paustian criteria with Logan's modification.[22] Response to anti-TB treatment as a criteria to confirm TB has also been used in other studies.[23] Additional tests like Purified Protein Derivative (PPD) have limited value in regions endemic to TB and are not recommended by the Revised National Tuberculosis Control Program guidelines from India for diagnosis of TB.[24] Because of insufficient data, QuantiFeron test is relatively contraindicated in the evaluation of active TB as active TB can be associated with suppressed interferon-γ responses.[25,26] Culturing intestinal biopsy specimens is expensive, and has been shown to be of low yield in previous studies. None of the 62 patients studied by Singh *et al*.[27] were positive on culture and only 3 out of 50 intestinal biopsy specimens in the study by Shah *et al*.[20] showed positive cultures.

Analysis of the data collected was performed using Microsoft Excel for Mac 2011, Version 14.1.4.

Anti-TB treatment. Anti-TB medications included Isoniazid, Rifampin, Pyrizanamide and Ethambutol for 2 months, followed by Isoniazid and Rifampin for 7 months, as per the 2003 Centre for Disease Control guidelines for treatment of TB.[28,29] The median duration of treatment was 9 months. Patients were followed up at regular intervals to assess clinical response.

RESULTS

Patients. Sixty-nine patients (mean age 39.3 $\pm$ 14.8 years; male 45, female 24) were enrolled. Five patients had confirmed diagnosis of TB and 64 were suspected to have colon TB (Figure 1). Seven patients were lost to follow-up. Two patients did not respond to treatment and were subsequently diagnosed to have Crohn's disease. Five patients underwent surgery before repeat colonoscopy could be performed and seven patients refused follow-up colonoscopy. The remaining 48 patients (including five with confirmed TB) underwent a repeat colonoscopy. None of the patients were positive for HIV or were taking any immunosuppressive medications.

Clinical features and diagnostic investigations. Majority of the patients presented with weight loss, abdominal pain, or altered bowel habit in the form of diarrhea or diarrhea alternating with constipation (Table 1). Physical examination revealed an abdominal mass in only 13.4% of patients and lymphadenopathy was even less commonly seen (1.5%).

Chest X-ray results were available in 32 patients; it was normal in 21 patients and abnormal in 11 (8 showed changes in the apical fields suggestive of previous TB, 2 had minimal unilateral pleural effusions and 1 patient had consolidation). Forty-four patients underwent ultrasound of the abdomen—10 patients had normal scan and the scan was abnormal in 34 (25 with bowel thickening in right flank, 12 with abdominal lymphadenopathy and 8 with ascites). Among eight patients with ascites, seven had minimal ascites not amenable to paracentesis. One patient underwent paracentesis. Although

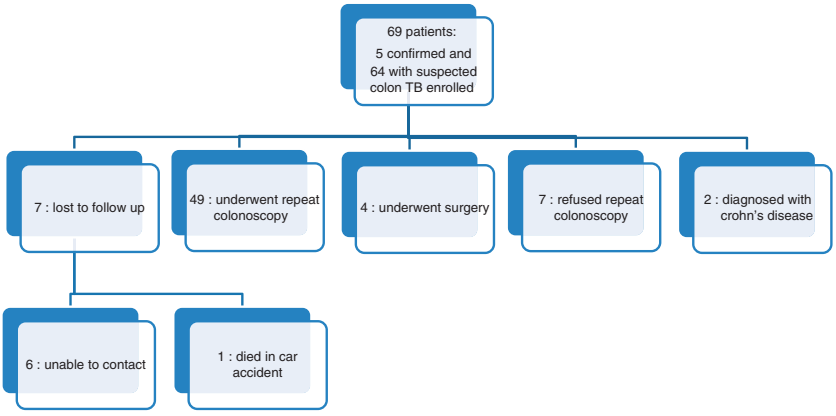

Figure 1 Patients enrolled.

Table 1 Clinical features on presentation

	Number of patients	Percentage of patients (%)
Symptoms		
Abdominal pain	54	80.60
Weight loss	50	74.63
Appetite loss	42	62.69
Fever	27	40.30
Diarrhoea	11	16.42
Alternate diarrhoea and constipation	17	25.37
Bleeding per rectum	8	11.94
Abdominal mass	3	4.48
Physical examination		
Pallor	30	44.78
Fever	23	34.33
Abdominal tenderness	25	37.31
Abdominal mass	9	13.43
Lymphadenopathy	1	1.49

acid-fast bacilli were negative, ascitic fluid was positive for adenosine deaminase.

Index colonoscopy. On index colonoscopy, macroscopic lesions were predominantly identified in the right colon (Figure 2). Thirty-one patients had single-site involvement and 36 patients had multiple sites involved. Lesions included ulcerations, nodularity, polyps, and luminal narrowing. Ulceration was the most common lesion (88.0%) seen (Table 2). These ulcers were predominantly linear/fissured, transverse or circumferential and covered with dull-white/yellow exudates. The mucosa around the ulcers showed inflammatory changes in the form of edema, erythema, or nodularity. No aphthous ulcers were observed. Twenty-three patients (32.8%) had deformed ileocecal valve. Polypoid TB lesions in the colon mimicked colon cancer. Luminal narrowing could not be negotiated in 18 patients—11 in the cecum, 3 in the ascending colon, 3 in the transverse colon, and 1 in the descending colon. Among these 18 patients, 4 subsequently underwent surgery for acute bowel obstruction. An 18-year-old male patient was started on anti-TB medications but within 2 weeks developed sub-acute bowel obstruction requiring surgical resection of a large mass in the distal one-third of the transverse colon. Resected specimen showed multiple

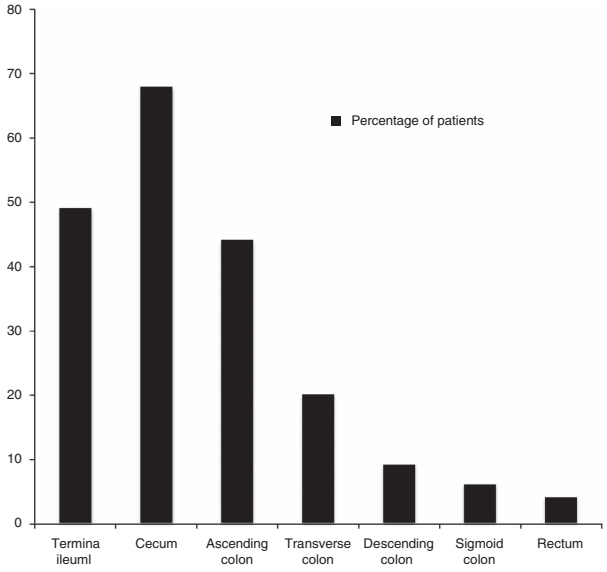

Figure 2 Frequency (%) of colon sites involved with tuberculosis.

caesating epitheloid granulomas and Langhans giant cells in mesenteric lymph nodes. Another patient, a 55-year-old female patient, on colonoscopy had severe narrowing at hepatic flexure and subsequently underwent right hemicolectomy. Histology showed multiple caesating epitheloid granulomas and Langhans giant cells. A third patient, a 42-year-old female with a palpable right lower quadrant mass, underwent surgery within 2 weeks of starting anti-TB treatment. Surgical specimen showed caesating epitheloid granuloma and Langhans giant cells with TB lymphadenitis. A fourth patient, a 32-year-old male, presented with bowel obstruction within 1 week of starting anti-TB treatment and underwent surgery. Histology showed caseating epitheloid granulomas and Langhans giant cells. Another patient underwent surgery for a polypoidal mass mimicking colon cancer. Histology showed caseating granulomas.

Histology. As shown in Figure 3, various forms of granulomas were identified in 50 patients (73.1%). Caseating granulomas were seen in the biopsy specimens of two

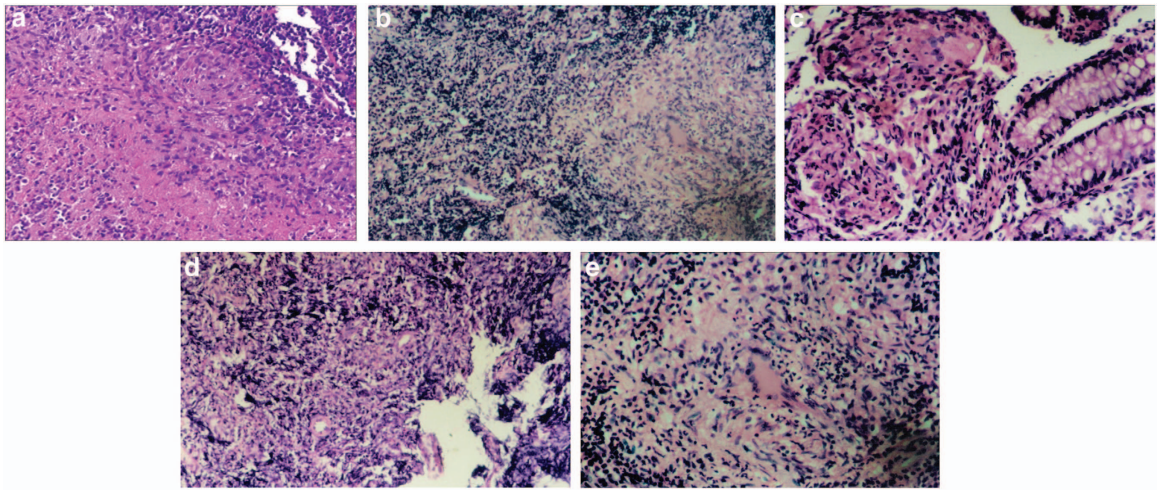

Figure 3 Colon tuberculosis histology. (**a**) Caseating epitheloid granuloma, (**b**) caseating granuloma with Langhans giant cell, (**c**) well-defined epitheloid granuloma, (**d**) Langhan's giant cell, (**e**) ill-defined epitheloid granuloma.

Table 2 Type of lesions noted on index colonoscopy

Type of lesion	Number of patients	Percentage of patients (%)
Ulcers	60	88.0
Nodules	34	50.7
Luminal narrowing	30	44.8
Polypoid lesion	7	10.4

patients and were also seen in all the resected specimens in those who underwent surgery. Other types of granulomas seen were well-defined non-caseating epitheloid granuloma, epitheloid granuloma with Langhans giant cells, and ill-defined non-caseating epitheloid granuloma. Other findings included non-specific chronic inflammation and loosely arranged epitheloid cells without and with fibrosis. Acid-fast bacilli were seen in three patients (6.4%).

Treatment duration. Thirty-eight patients were treated for 9 months. Ten patients did not come for their follow-up colonoscopy as scheduled and continued taking anti-TB drugs for a longer duration (one patient for 10 months and nine patients for 12 months). None of the patients reported any side effects from anti-TB drugs. Liver function tests were routinely checked while patients were on treatment and none of the patients had any elevation in liver enzymes.

Follow-up colonoscopy. Seven patients refused follow-up colonoscopy. Five of these patients had index colonoscopy and while on anti-TB treatment developed acute bowel obstruction. Four of these patients had luminal narrowing and one had a polypoidal mass mimicking colon cancer. Thus, 4 of 30 (13.3%) patients with luminal narrowing and 1 of 7 (14.3%) patients with a polypoidal mass on index colonoscopy underwent surgical intervention for colon obstruction. Endoscopic dilatation to relieve obstruction was offered but the patients and the referring doctors preferred surgery secondary to the acuteness of the clinical presentation.

Forty-eight patients underwent follow-up colonoscopy within 4 weeks after completing anti-TB treatment. Follow-up colonoscopy in majority of the patients showed either healing of previously seen mucosal lesions (Figure 4) or mild mucosal irregularities at the site of the previously seen lesions. As seen in Table 3, 87.2% ulcers, 84.6% nodules, 85.7% polypoid lesions, 76.2% luminal narrowing, and 76.5% ileo-cecal valve deformities resolved with anti-TB treatment. Seven patients had residual lesions (Table 4): deformed ileocecal valve (three patients), superficial terminal ileal ulcer (one patient), nodularity in terminal ileum (one patient), cecal stricture (one patient), polypoidal lesion in ascending colon (one patient), and residual narrowing in ascending colon and cecum (one patient). Biopsies taken from these lesions did not shown changes suggestive of TB.

Except for the four patients with luminal narrowing described above who required surgery, the lesions in all the other patients including nine with non-negotiable narrowing on index colonoscopy resolved with anti-TB treatment, thereby suggesting that luminal obstruction from these lesions was predominantly secondary to inflammatory edema, ulcerations and masses rather than fibrosis that resolved with treatment.

Patients diagnosed with inflammatory bowel disease. Two patients with suspected diagnosis of colon TB were later diagnosed to have Crohn's disease. One patient was a 25-year-old male presenting with chronic abdominal pain, diarrhea, low-grade fever, loss of appetite and weight loss. Colonoscopy revealed ulcers in the terminal ileum and cecum. Biopsy showed non-granulomatous chronic inflammation, negative for acid-fast bacilli. TB PCR was negative and test for anti-*Saccharomyces cerevisiae* antibodies was negative as well. Chest X-ray was normal and computerized tomography of the abdomen revealed terminal ileal thickening with abdominal lymphadenopathy. He was started on anti-TB treatment. Three months later the patient presented with worsening symptoms, lower gastrointestinal bleeding and stomatitis. Colonoscopy revealed deformed and ulcerated ileocecal valve with multiple, patchy, deep ulcerations

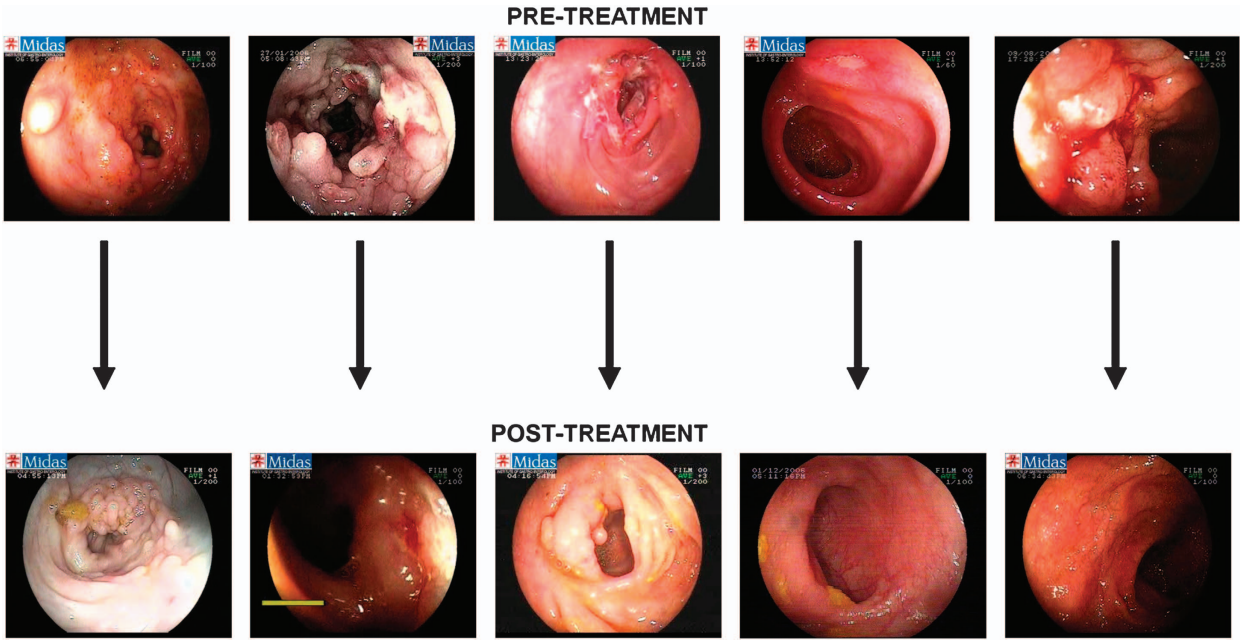

Figure 4 Healing of tuberculosis lesions with anti-tuberculosis treatment as shown on follow-up colonoscopy.

Table 3 Type of lesions and healing after anti-TB treatment

Routine analysis	Initial number of patients	Complete healing of lesions	Incomplete healing of lesions	Surgery	Percentage with complete healing (%)
Ulcers	47	41	2	4	87.20
Nodules	26	22	2	2	84.60
Luminal narrowing	21	16	1	4	76.20
Polypoidal lesions	7	6	0	1	85.70
Deformed ileo-cecal valve	17	13	2	2	76.50
Intention to treat analysis	**Initial number of patients**	**Complete healing of lesions**	**Incomplete healing of lesions**		
Ulcers	60	41	19		68.30
Nodules	34	22	12		64.70
Luminal narrowing	30	16	14		53.30
Polypoidal lesions	7	6	1		85.70
Deformed ileo-cecal valve	23	13	10		56.50

throughout the colon with normal intervening mucosa. Biopsy again showed non-granulomatous chronic inflammation. The patient was suspected to have Crohn's disease and was started on prednisone, azathioprine, and mesalamine, resulting in improvement of symptoms. Follow-up colonoscopy revealed significant resolution of inflammation.

The other patient was a 29-year-old male presenting with chronic abdominal pain and weight loss. Colonoscopy revealed deep ulcer at the ileocecal valve. Biopsy showed granulomatous colitis, negative for acid-fast bacilli. Chest X-ray was normal. The patient was started on anti-TB medications. Although the patient had symptomatic relief, a repeat colonoscopy after 9 months revealed a deformed and stenosed ileocecal valve with active ulcerations in the terminal ileum. Biopsy again showed granulomatous colitis. Anti-*Saccharomyces cerevisiae* antibodies were negative. The patient was suspected to have Crohn's disease and was started on prednisone, azathioprine and mesalamine with significant improvement of symptoms. Repeat colonoscopy showed healing of ulcers.

DISCUSSION

M. tuberculosis infection is endemic in many countries and there has been a resurgence of TB in the Western world.[9] The annual global incidence of TB is estimated to be 9.4 million cases.[1] A report from a panel of TB experts and epidemiologists from more than 40 countries showed that an estimated 1.87 million (1.4 million–2.8 million) people died of TB in 1999.[30] The global case fatality rate was 23% and exceeded 50% in some African countries with high HIV prevalence rates.[30] The resurgence of TB in many

Table 4 Colonoscopic features of patients with partial resolution of lesions

Initial colonoscopy	Follow-up colonoscopy
Ulceration, nodules and narrowing in ascending colon and deformed ileocecal valve	Ileocecal valve remained deformed, ascending colon lesions resolved
Cecal ulceration and terminal ileal ulceration, nodule and narrowing	Small superficial ulceration noted in terminal ileum, complete resolution of cecal ulcers
Ulcerations and nodules in cecum, ascending colon	Polypoid lesion in ascending colon, complete resolution of cecal ulcers
Cecal ulceration and nodularity	Cecal narrowing
Cecal and terminal ileal ulceration and nodularity	Minimal nodularity of terminal ileum, complete resolution of cecal ulcers
Multiple ulcerations in ileo-cecal valve and terminal ileum	Healing ulcers with distortion of ileocecal valve and stricture
Multiple ulcerations with narrowing of hepatic flexure, scope could not be negotiated	Complete healing of previously seen ulcers, narrowing present in ascending colon and cecum, scope could be negotiated

developed countries has been attributed to higher migrating population, deteriorating social conditions, cutbacks in public health services and increasing prevalence of immuno suppressed/HIV-positive individuals.[3–9] In the United States, this escalation peaked in 1992 and since then there has been a steady decline, with TB now being diagnosed mostly in the migrant population.[8,9]

Gastrointestinal TB, although not as commonly seen as pulmonary TB, can be a source of significant morbidity and mortality as it can mimic other conditions and tends to be diagnosed late. Less than 25% of patients with gastrointestinal TB have concomitant pulmonary TB.[9] Hence diagnosing gastrointestinal TB requires a high index of suspicion, especially in countries where TB is not endemic. Some of these patients are misdiagnosed as having inflammatory bowel disease and may get immunosuppressant medications resulting in dissemination of TB.

The intestinal tract is usually affected by swallowed bacterium, spread from adjacent organs or via hematogenous spread. Secondary to abundant lymphoid tissue and the relatively longer contact time of intestinal contents with the mucosa, the terminal ileum has a higher predilection for TB infection.[9,11,14] Hence, in an appropriate clinical setting (for example, an immunosuppressed patient or immigrant population), TB is always in the differential diagnosis if there is an ulcer, stricture or an inflammatory mass in the terminal ileum. However, diagnosing TB of the colon requires a high index of suspicion as colon is not the most commonly affected site and symptoms are non-specific. In a study by Nagi *et al*.,[17] only 10.8% of the 684 cases with abdominal TB had TB affecting the colon. Case reports and small retrospective case series have been published describing the endoscopic features of TB of the colon.[11–18,20,21,31–38] These features can be non-specific and mimic inflammatory bowel disease or malignancy. As follow-up colonoscopy is not routinely performed after completion of anti-TB treatment, there are limited data on predicting the outcomes of TB lesions, namely, resolution of, lack thereof, or scarring or stricturing of the lumen after healing.

In this study, we report on one of the largest cohorts of patients with colon TB who were followed prospectively with colonoscopy examination after completing anti-TB treatment. Similar to previously reported case series,[11,21,35,39] majority of the patients had non-specific symptoms, with weight loss and abdominal pain being the predominant symptoms in over 80% of the patients. Less than half of the patients in this study had fever. Abdominal mass on physical examination was noted in only 6.4% of the patients. The number is significantly less compared with the study by Palmer *et al*.[40] in which 43% patients developed abdominal mass comprising either inflammatory intestinal lesions or enlarged mesenteric lymph nodes. The difference is likely due to the fact that their series had predominantly small bowel involvement (40 of 42) compared with only 4.7% showing isolated TB affecting the colon. Bleeding per rectum was observed in 20% of patients in the present series, but none of these was severe enough to require surgical or angiographic intervention. In the series by Misra *et al*.[35] 10% of patients required surgery for massive lower gastrointestinal bleeding. Similar to previously published series,[11,21,35] in our study, the predominant lesions identified on colonoscopy were ulceration and nodularity. The right colon (ileocecal valve, cecum, and ascending colon) was significantly more affected compared with the left. Nagi *et al*.[17] on the other hand found the transverse colon to be the most commonly affected site and strictures the predominant lesion. However, their study was based on radiological evaluation and not colonoscopy.

On the basis of the above, the symptoms and the endoscopic findings of colon TB can be non-specific and hence diagnosing TB of the colon can be difficult. We had six patients with previous pulmonary TB as seen on chest X-ray and one patient with ascites had positive adenosine deaminase test. Histology was supportive of TB in 73% of the patients. Three patients showed positive acid-fast bacillus on histology; granulomas were the predominant finding in other patients, but as reported previously,[35] caseating granulomas were rarely seen. In the current series, caseating granulomas were present in two patients and in all the five resected specimens of those who underwent surgery. Majority of the patients presented with suspected TB and diagnosis was confirmed by response to anti-TB treatment. Response to anti-TB treatment as a criterion to confirm TB has also been used in other studies.[23] Although it will be difficult to justify empiric anti-TB treatment for patients in developed countries, this has been an acceptable approach in countries where TB is endemic. Park *et al*.[41] compared the outcomes of anti-TB treatment in patients with non-specific ileocecal ulcers. They showed that 3 months of trial of anti-TB treatment can be sufficient to assess response to treatment and thus differentiate between colon TB and Crohn's disease. Our study results are consistent with this, as majority

of the patients had significant clinical improvement within 4–6 weeks after initiation of anti-TB treatment. Skin Purified Protein Derivative (PPD) and QuantiFeron tests can be used as supportive evidence in regions non-endemic for TB, but their utility in endemic areas is questionable. Hence Purified Protein Derivative (PPD) test is not recommended by the Revised National Tuberculosis Control Program guidelines from India for diagnosis of TB.[24] QuantiFeron test is relatively contraindicated in the evaluation of active TB, as active TB can be associated with suppressed interferon-γ responses.[25,26] *M. tuberculosis* culture from intestinal biopsy specimen is expensive and previous studies have shown variable yield.[12,27,35,42] In a study by Singh *et al*.,[27] none of the 62 patients showed positive cultures and only 3 out of 50 intestinal biopsy cultures in a study by Shah *et al*[20] showed *M. tuberculosis*. Hence, we elected not to culture the biopsy specimens.

Two patients who did not respond to anti-TB treatment were eventually diagnosed to have inflammatory bowel disease. None of the patients received any empiric immunosuppressant medications before anti-TB treatment on the assumption that they have inflammatory bowel disease, for fear of dissemination in case they had TB. Differentiating TB ulcer from Crohn's disease ulcer has always been challenging.[19,34,43–49] In this series, TB ulcers were linear, fissured, transverse, or circumferential. Similar to as reported by others,[11,20,50] we also observed that the mucosa surrounding TB ulcers was abnormal, showing features like erythema, edema, mucosal irregularity or nodularity. In Crohn's disease, the ulcers are usually surrounded by normal-looking mucosa. Moreover, aphthous ulcers as seen with Crohn's disease were not observed, except in the patient who subsequently was diagnosed to have Crohn's disease. Crohn's patients can present with significant gastrointestinal bleeding.[51] None of the patients in the current series had any significant colonic bleeding. However, this feature cannot be used as suggestive of TB as in a previous case series 10% of patients with colon TB required interventions for massive gastrointestinal bleeding.[35] Multiple studies have attempted to identify features to differentiate between TB and Crohn's disease. A study by Makharia *et al*.[23] attempted to calculate a scoring system based on the following features—weight loss, absence of sigmoid colon involvement, absence of blood in stool and absence of focal colitis to differentiate between Crohn's and TB. Another study by Lee *et al*.[49] evaluated various other endoscopic features to differentiate between Crohn's disease and colon TB. Four parameters—anorectal lesions, longitudinal ulcers aphthous ulcers and cobblestone appearance—were significantly more common in patients with Crohn's disease than in those with intestinal TB. Four other parameters—involvement of fewer than four segments, a patulous ileocecal valve, transverse ulcers, and scars or pseudopolyps—were more frequently observed in patients with intestinal TB than in those with Crohn's disease. However, there have not been any large population-based studies to validate these findings. A study by Gan *et al*.[52] showed that PCR can be useful in distinguishing between Crohn's and TB. Pulimood *et al*.[53] described histological features—type and frequency of granulomas, the presence or absence of ulcers lined by epithelioid histiocytes and microgranulomas and the distribution of chronic inflammation being useful to distinguish between the two diseases.

Luminal narrowing was noted in 30 patients in the current series. Four patients (13.3%) with luminal narrowing on index colonoscopy and one patient with an obstructing polypoidal mass mimicking colon cancer required surgery. We were unable to assess the efficacy of endoscopic dilatation in these patients as they were taken to surgery before endoscopic intervention could be applied. In a previous series, endoscopic dilatation of colon strictures was performed and was shown to be effective and safe.[35,54] In the remaining patients, the narrowing resolved with anti-TB treatment, thereby suggesting that these strictures were inflammatory in nature. Majority of the other types of lesions (ulcers, nodularity, and polyps) also resolved with anti-TB treatment, as confirmed on follow-up colonoscopy.

The findings of our study have important implications. As majority of the patients had resolution of the colon lesions with anti-TB medications, follow-up colonoscopy may not be required in patients with colon TB if they are asymptomatic after treatment. Majority of the luminal narrowing as noted on index colonoscopy also resolve with anti-TB treatment and hence these strictures appear to be inflammatory rather than fibrotic in nature.

This study had several limitations. First, few tests were performed owing to patients concerns regarding the cost involved and hence small bowel enterography and computerized tomography/US of the abdomen were not performed in all the patients. Second, we did not perform culture for TB as previous studies have shown variable yield.[27,35,41,42,55] We could have performed *Mycobacterium* culture in the two patients who did not respond to conventional anti-TB treatment to evaluate for drug-resistant TB. However, follow-up colonoscopy features were suggestive of Crohn's disease and these patients responded to prednisone. Although the prevalence of Crohn's disease is low in India, there is always a chance of falsely labeling a Crohn's disease patient as having colon TB with resolution of lesions secondary to the anti-inflammatory effect of anti-TB medications. However, a study by Park *et al*.[41] demonstrated that patients with suspected inflammatory bowel disease treated with anti-TB medications did not have any significant lasting improvement in symptoms or resolution of lesions seen on colonoscopy. Eventually, while on anti-TB medications these patients may present with ongoing active disease, as was seen in the two patients with Crohn's disease in our study. The findings of our study are not applicable to HIV-positive or immuno-compromised patients as none of the patients in our study were HIV-positive or immunosuppressed.

In summary, patients with TB of the colon present with nonspecific symptoms and hence diagnosis in countries where TB is non-endemic involves a high index of suspicion (migrant population, immuno-suppressed individuals). Abdominal pain and weight loss are the predominant symptoms. Ulceration, nodularity, and luminal narrowing are the prominent endoscopic findings mostly affecting the right colon. Histology is helpful in ruling out other conditions, but TB-specific findings like caseasting granuloma and acid-fast bacilli are rarely seen. Tuberculous ulcers are morphologically different form

Crohn's ulcers in that they are predominantly linear, fissured, transverse, or circumferential and the mucosa surrounding these ulcers is abnormal. Majority of the colon lesions resolve with anti-TB treatment, including strictures, thereby suggesting that strictures are more inflammatory rather than fibrotic in nature. Follow-up colonoscopy is not required in those who have symptomatic improvement after anti-TB treatment.

CONFLICT OF INTEREST

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Financial support: This study was supported by the Midas Medical Foundation grant.

Potential competing interests: None.

Study Highlights

WHAT IS CURRENT KNOWLEDGE

- Increasing number of cases are being described with colon TB.
- There are limited prospective studies looking at the outcomes of TB colon lesions.

WHAT IS NEW HERE

- Right colon is affected more than left.
- Lesions can be nodules, polyps, ulcers, strictures or masses.
- Majority of the lesions are inflammatory in nature (including strictures) and hence resolve with anti-tuberculosis treatment.

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