MDCT enterography a new diagnostic tool for gastrointestinal tuberculosis: an initial experience

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Purpose

Gastrointestinal (GI) tuberculosis is an important extra-pulmonary manifestation of tuberculosis and constitutes a major health problem in the developing world. Its incidence is also on a rise in the Western world with the increased in HIV cases and immigrant population (1). Due to a variable pattern of morphological and pathological alteration intestinal tuberculosis can have a varied clinical presentation and can imitate almost any GI disease (1). Therefore, it is important to recognize the imaging features of GI tuberculosis and differentiate it from other small bowel diseases to guide treatment. It is very essentially to distinguish Crohn's disease a common occurrence in the western world from tuberculosis; as steroid therapy is the mainstay of treatment in Crohn's disease but may prove to be disastrous in tuberculosis (2).

MDCT Enterography (MDCTE) is a promising diagnostic tool for small bowel imaging which is otherwise difficult to evaluate due to its length, caliber and overlapping of bowel loops (3). This technique combines the advantages of both the excellent spatial resolution of MDCT and optimal small bowel distention achieved by oral ingestion of large volume of neutral contrast agent. Thus, MDCTE allows comprehensive evaluation of the small bowel lumen, mucosa and wall, the perienteric tissues, mesentry, peritoneum and also the solid organs (4). As there is no need for fluoroscopic naso-duodenal intubation, it is a well tolerated technique, and involves less radiation, time and cost as compared to CT Enteroclysis (5).

Magnetic resonance (MR) enterography and enteroclysis are alternate imaging techniques available for evaluation of the small bowel. Though MR has gained wider acceptance due to better patient tolerance and its non invasive nature, literature suggests that the MR has faired less well in evaluation of bowel lesions due to poor spatial resolution, motion artifacts and longer acquisition time(6). Also limited availability and cost of the investigation is a matter of concern especially in the developing world.

As MDCT Enterography is a new technique for detecting GI tuberculosis, we wish to share our initial experience and present the spectrum of findings in 17 patients of proved GI Tuberculosis.

Methods and Materials

This study was carried on thirty adult patients of either sex presenting with clinical suspicion of small bowel disease after obtaining approval from the institutional ethical committee and taking written informed consent from the patients.
MDCTE was acquired on a 64 slice scanner after oral intake of 1800ml of iso-osmotic Mannitol (500 ml in each 15 min for 45 minutes duration, followed by a table dose of 300 ml to distend the stomach). Intravenous injection (IV) of 20 mg of Hyoscine Butylbromide was given prior to scanning. Non-contrast (NCCT) and contrast-enhanced CT (CECT) was acquired using a predefined protocol (table 1).

<table>
<thead>
<tr>
<th>Scanning extent</th>
<th>Diaphragm to pubic symphysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>120</td>
</tr>
<tr>
<td>Effective mAs</td>
<td>165</td>
</tr>
<tr>
<td>Detector collimation</td>
<td>NCCT 3 mm</td>
</tr>
<tr>
<td></td>
<td>CECT 1 mm</td>
</tr>
<tr>
<td>Slice thickness</td>
<td>NCCT 5 mm</td>
</tr>
<tr>
<td></td>
<td>CECT 2 mm</td>
</tr>
<tr>
<td>Interval reconstruction</td>
<td>NCCT 1.5 mm, smooth kernel</td>
</tr>
<tr>
<td></td>
<td>CECT 1.0 mm, smooth kernel</td>
</tr>
<tr>
<td>IV contrast (non-ionic contrast)</td>
<td>300 mg iodine/ml at the rate of 3ml/sec</td>
</tr>
<tr>
<td>Amount</td>
<td>80 to 120ml</td>
</tr>
<tr>
<td>Acquisition time</td>
<td>45 sec after starting of scan</td>
</tr>
<tr>
<td></td>
<td>during the enteric phase of contrast enhancement</td>
</tr>
</tbody>
</table>

Table 1: MDCT Enterography scanning protocol

The MDCTE was evaluated for adequacy of distension and enhancement of the small bowel (divided arbitrarily into 5 segments- jejunum as J1 & J2, ileum as I1, I2, I3) in all thirty patients, independently by 2 reviewers. The detailed evaluation of the lumen, mucosa and the wall of the small bowel, ileo-cecal junction and the caecum was done. The mesentery, lymph nodes, omentum, peritoneum and the solid organs were also examined.
The imaging diagnosis made on MDCT Enterography was compared with the final diagnosis based on endoscopy/ laparoscopy/ surgery/ histopathological examination. Seventeen patients finally proved to have GI Tuberculosis. Detailed analysis of the spectrum of MDCTE findings in these 17 patients was then done.

The sensitivity and specificity of MDCT Enterography for diagnosing GI Tuberculosis was also calculated.

Inter observer agreement among two reviewers for adequacy of luminal distension and bowel wall enhancement for all the small bowel segments was calculated (Kappa value using SPSS16.0 software).

Results

Of the 17 patients 10 were males and 7 were females. The age ranged from 18 to 42 years with the mean age of 31.6 years. Commonest clinical symptom was pain in abdomen (86%) followed by altered bowel habits (36%) and fever (33%). Abdominal Tuberculosis was clinically suspected in 12 out of 17 (71%) patients.

Ileocecal (IC) junction was the commonest site of involvement seen in 88% cases followed by caecum (59%) and terminal ileum (59%), ascending colon (12%) and jejunum (6%).

Circumferential focal / segmental bowel wall thickening (more than 3mm & 5mm in distended & collapsed phase respectively) was the commonest CT finding, in all (100%) patients of GI tuberculosis. The IC junction involvement was seen as thickening (93%) with or without a stricture, abnormal wall enhancement (53%), and abnormal pulled-up position with altered IC angle (40%). One patient (12%) had obliteration of the IC angle with a patulous IC junction opening into the ascending colon. The caecum was thickened and its lumen completely obliterated. (Refer to figures 1-4)

Two third patients with an abnormal IC junction also had a concurrent caecal involvement. The involved caecum demonstrated thickening in all except one patient, where it only appeared conical in shape. In 40 % cases the caecum was also contracted and placed high in position. In two patients (12%) the ascending colon was also involved showing wall thickening. (Refer to figures 5- 7)

Wall hyper-enhancement (finding not previously reported in GI tuberculosis) was present in 48% patients, and was always associated with regions of focal, segmental bowel wall thickening, commonly at the I/C junction (refer to figure 8). The stricture was seen as a circumferential thickening of wall causing luminal compromise and proximal dilatation and seen in 36% patients. Hyper enhancement of the thickened wall was seen in all the strictures (inflammatory) except one stricture which was found to be fibro-stenotic
on surgery. In two cases of strictures (12%) also demonstrated small bowel faecal sign and luminal enteroliths. Perienteric stranding was also a significant finding seen in 42% patients and always seen in association with regions of bowel wall thickening. (Refer to figure 9)

24% patients had matting of bowel loops with evidence of segmental dilation of the involved loops as well. This feature is attributed to associated tubercular peritonitis in these patients. (Refer to figure 12)

Lymph node enlargement was the commonest extra-intestinal finding with significant lymph nodal enlargement (short axis diameter more than 1 cm) was seen in 82% (14 out of 17 patients). Mesenteric group was commonly involved (72%) followed by periportal (12%), pericaecal (12%) and paraaortic, perigastric, periesophageal (6% each). Central necrosis was present in only 48% patients. (Refer to figures 10, 11)

Over all 48% patients also showed peritoneal involvement, the commonest finding was a loculated collection- 42%, thickening- 36% and calcification 6%. In one patient the loculated collection appeared hyperdense. Two patients (12%) also had presence of ascites. (Refer to figure 12)

Associated omental abnormality was seen in 30% patients of GI tuberculosis in the form of thickening and calcification in 24% & 18% patients respectively.

Ileo-colic fistula was seen in one patient of Ileocecal tuberculosis (6%). (refer to figure 13) Hepato-splenomegaly with granuloma, splenomegaly, adnexal lesion, pleural effusion with pulmonary koch's, psoas abscess was present in 6% each.

Sensitivity and specificity of MDCTE for diagnosing GI Tuberculosis was 100% and 95.65 % respectively.

Luminal distension was optimal in 84.6%, whereas bowel wall enhancement was optimal in 91% of small bowel segments. The inter observer agreement for distension was 0.743 (substantial) and for enhancement it was 0.842 (perfect).

Images for this section:
Fig. 1: A coronal MPR image of MDCT Enterography image showing the normal IC junction, caecum, and visualized bowel loops
Fig. 2: MDCTE showing circumferential, enhancing mural thickening involving the IC junction and terminal ileum. Caecum appears normal. Small bowel is not dilated
**Fig. 3:** MDCTE sagittal oblique image demonstrates the thickened and strictured IC junction with proximal dilatation and small bowel faecal sign. The caecum appears normal.

![Image](image1)

**Fig. 4:** MDCTE sagittal image shows the distorted, gaping IC valve. The IC, ascending colon, caecum and terminal ileum has enhancing mural thickening. The caecum is contracted while the stricture is involving the ascending colon at its origin. The coronal image shows the proximally dilated ileal loop with an enterolith and a focal, symmetrical enhancing wall mural thickening.
Fig. 5: MDCTE coronal image showing two inflammatory strictures in the terminal ileum with proximal dilatation. The IC is involved and caecum is contracted and conical. Minimal thickening of the medial wall of the caecum is seen.
**Fig. 12:** MDCTE was helpful in demonstrating multiple loculated peritoneal and mesentric collections causing matting of the bowel loops for features of SAIO in this patient. Segmental dilatation of the jejunal loops with transition zone but normal bowel wall thickness and distally collapsed and matted loops are evident. The mesentry is dirty and peritoneal enhancement is seen.

**Fig. 11:** Axial image at the level of portal vein showing multiple, markedly enlarged necrotic peri portal and peri pancreatic lymph nodes. An irregular small hypodense rounded lesion is seen in segment 5 of liver which proved to be a granuloma.
**Fig. 10:** MDCTE axial image showing enlarged, necrotic lymph nodes involving different groups. A focal circumferential ileal loop thickening is seen on the left. Omental thickening is also evident in the image. The mesentry is thick and stranded.
**Fig. 9:** MDCTE image showing gross thickening affecting the caecum and terminal ileum and IC valve. The classical distribution and concentric nature of the mural thickening point towards its etiology. Marked perienteric inflammatory changes and mildly enhancing lymph node are evident. Few enlarged mesentric lymph nodes are also seen.
Fig. 8: MDCTE axial image showing hyperenhancement of the circumferential wall thickening involving the terminal ileum with evidence of perienteric stranding as well. Another similar focal finding is seen in the proximal ileum.
Fig. 7: MDCTE coronal shows classical involvement of the IC junction, Caecum and terminal ileum by circumferential, segmental, enhancing mural thickening in a patient
of ileo-caecal Kochs. The ascending colon is similarly involved and a large enhancing perienteric lymphnode is evident.

**Fig. 6:** MDCTE axial image of right iliac fossa shows a thickened, non-enhancing wall of a contracted caecum with a hypodensity in its wall. Pericaecal stranding is seen in the image. The ic junction (not seen in the image) was involved.
Fig. 13: MDCTE axial image shows asymmetrical mild obstructive thickening and narrowing of the terminal ileum with evidence of a enhancing tract communicating with the colon suggestive of an ileo-colic fistula. An enhancing lymphnode seen adjacent to the bowel. The IC region and caecum were involved indicating a tubercular pathology.
Conclusion

Focal circumferential bowel wall thickening was the commonest finding seen universally in all our patients of GI tuberculosis. This was in concurrence to the existing literature where typical concentric mural thickening was the commonest CT finding (7).

The ileo-caecal junction was the most common site of involvement followed equally by caecum and terminal ileum. In our study all the patients with mural thickening at the caecum or ileum were associated with an abnormal IC junction. The presence of such lesions with simultaneous involvement of the IC junction is strongly suggestive of tuberculosis (8).

The ileum (59%) was far more commonly involved than the jejunum (6%) as also described in literature. This feature is attributed to the abundance of lymphoid tissue (Peyer patches) in the distal and terminal ileum (9).

The IC junction displayed a spectrum of abnormalities like obstructive or non-obstructive circumferential mural thickening, abnormal position and angle and patulous IC value. This finding of a patulous IC valve and loss of IC angle exists in literature (10, 11, 12). A destroyed gaping ileocecal valve is more likely to be caused by tuberculosis than crohn’s (13). Concurrent involvement of the caecum with IC junction and especially if it appears contracted and pulled up is specific for tuberculosis. We witnessed caecal abnormalities as symmetrical or asymmetrical (medial wall) thickening, abnormally high position and contraction without any mural thickening. These features are seen due to the presence of fibrosis (9).

Multiple lymph node groups were involved at the same time in our patients but mesenteric lymph nodes were the most commonly affected. Central necrosis within the enlarged nodes was present in less than half the number of cases. Abdominal lymphadenopathy is also the most common manifestation of abdominal tuberculosis, being seen in 55%-66% of patients (14). The characteristic pattern is mesenteric and peripancreatic lymph node group enlargement, with multiple groups affected simultaneously. A finding of hypoattenuating center and hyperattenuating enhancing rim at CT that is characteristic of, but not pathognomonic for, caseous necrosis is present in 40%-60% of patients with lymphadenitis (14, 15).

Almost half of our patients had peritoneal involvement which was seen as thickening, collection, ascites and calcification. The tubercular peritonitis has been divided into wet, fibrotic and dry type and has overlapping CT features (14).

Pericaecal and mesenteric stranding was present in a significant number of our patients. This finding has been described before by de Backer et al (16).
Hyperenhancement of the thickened bowel wall was a significant new finding revealed by the study. This finding can be contributed to imaging in the enteric phase of contrast enhancement, using negative oral contrast and adequate amount of IV contrast for MDCTE. Obviously the inflammatory nature of the pathology is evident by this finding. More insight is needed into this observation and it may have treatment implications.

All the other associated manifestations of tuberculosis like psoas abscess, pleural effusion etc were well demonstrated in our patients, which were useful imaging findings supporting the diagnosis of GI tuberculosis.

MDCT Enterography using iso-osmotic mannitol is a useful modality providing adequate luminal distention and bowel wall enhancement for evaluation of the small bowel. It clearly depicts the site and extent of intestinal manifestations of tuberculosis and also the extra-intestinal findings involving the lymphnodes, mesentry, peritoneum, omentum and the solid organs.

MDCT Enterography, thus, has the potential to be used as one stop imaging modality for diagnosing GI Tuberculosis.

References


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