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RADIOLOGICAL FEATURES OF ABDOMINAL TUBERCULOSIS: A REVIEW

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ABSTRACT The prevalence of abdominal tuberculosis persists to be high. It also poses a diagnostic challenge at times, it being difficult to differentiate from Inflammatory bowel disease, especially Crohns disease. This article reviews the various imaging modalities aiding the diagnosis of Abdominal tuberculosis.

KEYWORDS : Intestinal TB, Radiological features

INTRODUCTION:

Tuberculosis is one of the top 10 causes of death and the leading cause from a single infectious agent. Tuberculosis persists to afflict mankind, with reports of 5.6 million men, 3.2 million women and 1.2 million children developing tuberculosis in 2019. India leads the 30 high TB burden countries accounting for 87% of new TB cases[1]. India has about 26% of the world TB cases. Approximately one eighth of TB cases are extra pulmonary and of these abdominal tuberculosis (ATB) accounts for 11%-16% [2,3]. About 6% to 38% of patients with intra-abdominal TB have concomitant evidence of pulmonary TB [4]. Abdominal tuberculosis continues to challenge the treating physician, and at times leading to delay in diagnosis and institution of its timely treatment. This is due to its subtle clinical presentation and non-specific symptoms and it mimicking other pathologies mainly Crohns disease and malignancy on imaging. It is estimated that approximately 60 million lives were saved of TB following its timely diagnosis and treatment between 2000 and 2019 [1]. This underlines the importance of diagnostic modality utilized for the diagnosis of tuberculosis. The present article reviews various imaging modalities which aids in diagnosis of Abdominal tuberculosis, other than the tuberculous involvement of solid viscera.

Discussion:

Abdominal tuberculosis may affect either

1) Gastrointestinal tract (Intestinal)
2) Peritoneum
3) Lymph-nodes and
4) Solid viscera.

Gastro-intestinal TB

Gastrointestinal tuberculosis commonly involves the terminal ileum and caecum in more than 50 % of cases [5]. Factors attributed to the involvement of terminal ileum include stasis, presence of abundant lymphoid tissue, increased rate of absorption at this site and closer contact of the bacilli with the mucosa. It is classified into 3 types:

1) Ulcerative form of TB:

It is seen in approximately 60% of patients. They are characterized by presence of multiple superficial ulcers with the long axis of the ulcers classically being perpendicular to the long axis of the bowel. This form is considered to be a highly active form of the disease.

2) Hypertrophic form

It is seen in approximately 10% of patients. It consists of thickening of the bowel wall with scarring; fibrosis; and a rigid, mass-like appearance mimicking carcinoma.

3) Ulcero-hypertrophic form

It is seen in 30% of patients. These patients have a combination of features of the ulcerative and hypertrophic forms.

Peritoneal Tuberculosis:

Peritoneal tuberculosis is common presentation of abdominal tuberculosis[5]. It includes involvement of either peritoneal cavity, mesentery and omentum It is classified as:

1. Wet type: It presents either as free or loculated ascites, with or without diffuse and smooth peritoneal thickening
2. Dry type: There is thickening of either or both peritoneum or mesentery. There may be enlarged lymph nodes, presence of caseation within the lymph node and also fibrinous adhesions
3. Fibrotic-type: In this type there is omental thickening, entanglement and adhesions of bowel loops clinically resembling a mass, with loculated ascites at times

Tuberculous abdominal lymphadenopathy:

It occurs in 25–93 % of cases [6]. Owing to the lymphatic drainage from the commonly affected regions i.e., the small bowel, ileo-caecal region and, right side of the colon, the group of lymph nodes commonly affected are; mesenteric, omental, peripancreatic and upper paraaortic lymph nodes.

Imaging Modalities:

The imaging modalities commonly utilized for the diagnosis of intestinal tuberculosis are:

1. USG of the abdomen
2. Barium Studies
3. CECT Scan of the abdomen.
4. MRI of the abdomen

1. USG of the abdomen:

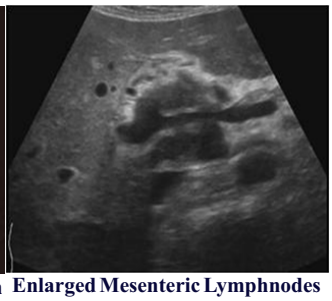
USG of the abdomen though easily available and affordable is generally not used to confirm the diagnosis of abdominal tuberculosis. It can at best give a subtle clue to the presence of abdominal tuberculosis. The USG findings [7] which hint towards presence of abdominal tuberculosis are:

1) Pulled up Ileocaecal region (Pseudo-Kidney sign) (Figure 1)
2) Mesenteric thickness (15 mm or more)
3) Increase in mesenteric echogenicity
4) Mesenteric lymphadenopathy (Figure 2)
5) Dilated small bowel loops
6) Presence of ascites

FIGURE 1

Pulled up ileocaecal region in subhepatic Position (Pseudo-Kidney Sign)

FIGURE 2



Enlarged Mesenteric Lymphnodes

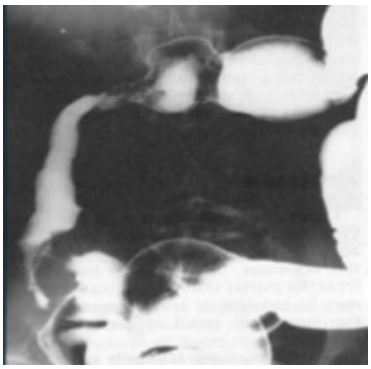
2. Barium Studies:

Until the advent of MDCT Scan and 3D CT imaging systems, barium studies was considered as the Gold standard modality of investigation in the diagnosis of Abdominal tuberculosis. Its biggest drawback is that it highlights only the luminal changes, without no information on extraluminal, peritoneal, nodal, and visceral involvement.

Occurrence of nodular thickening of mucosal folds, with loss of symmetry in the mucosal pattern is the earliest findings seen on Barium studies in patients of Intestinal tuberculosis. In the course of is natural history, ulcers are than seen, characteristically perpendicular to the

long axis of the bowel. Healing of these ulcers, leads to formation of annular strictures. Inflammation in the terminal ileum, leads to its irritation resulting in rapid emptying of the contrast, giving a appearance which is described as Stierlin sign [8]. Here the caecum is conical and shrunken. The IC valves are widely opened, and the terminal ileum is narrowed. Besides, there is rapid emptying of the contrast in the diseased segment. (Figure3).

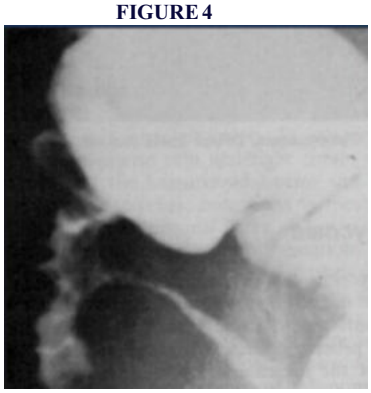
FIGURE 3



Stierlin Sign: Rapid emptying of the contrast in the diseased segment.

The thickening of the Ileocaecal valve with its wide gaping, and narrow terminal ileum gives an appearance of an inverted umbrella, which is described as Fleischners sign. (Figure 4)

FIGURE 4



Fleischners sign

Following healing of the ulcer there occurs fibrosis. This results in contraction of the mesocolon. This results in pulling up of the Ileo-caecal region. As a result, the normal IC angle which is acute, gets obliterated and becomes obtuse. The caecum becomes conical and shrunken. (Figure 5)

FIGURE 5

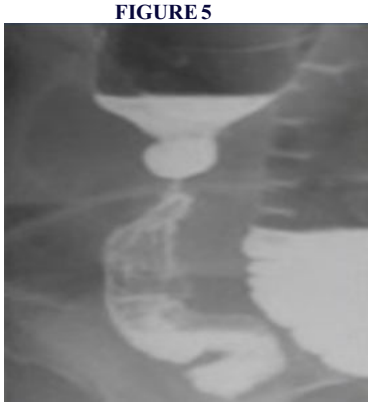
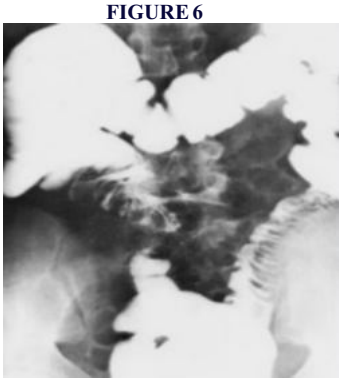


Figure 5: Pulled Up IC Junction with conical caecum.

The loss of normal IC angle, with dilated terminal ileum, gives an appearance as if it is hanging from a retracted and shortened caecum, in what is described as Goose-Neck deformity sign. (Figure 6)

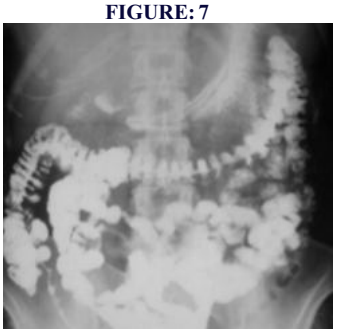
FIGURE 6



Goose-Neck deformity sign

Involvement of the entire length of the terminal ileum, leads to its narrowing resulting in narrow stream of barium in terminal ileum. This is described as String Sign (Figure7)

FIGURE: 7



String Sign

Thus, on Barium the features suggestive of Tuberculosis are:

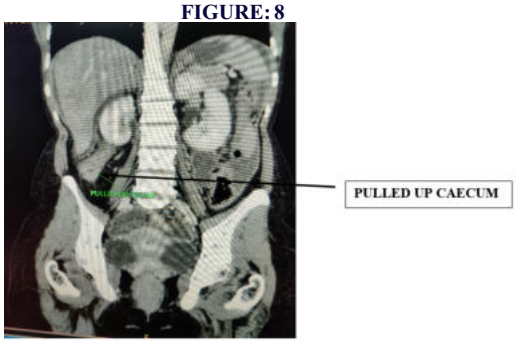
1) Stierlin Sign
2) Fleischners sign
3) Pulled Up IC Junction with conical caecum.
4) Goose-Neck deformity sign
5) String Sign

3. CECT Scan

The availability of MDCT along with advancements in 3D CT imaging systems has led CECT Scan to nudge ahead of the barium study, to become a first-line investigation modality for the evaluation of bowel pathology. It scores above barium studies in its ability to evaluate not only luminal, but also extraluminal, peritoneal, nodal, and visceral involvement in a single examination in diagnosis of patients with abdominal tuberculosis.

CECT Scan findings of intestinal tuberculosis include symmetrical or asymmetrical parietal thickening, extrinsic compression by enlarged lymph nodes, which may progress to formation of heterogeneous mass following its association with adherent loops and mesenteric thickening[9]. In advanced disease there is thickening of small bowel loops, adherent loops, enlarged lymph nodes, and mesenteric thickening. This together at times present as a soft tissue mass around the ileocecal junction. The ensuing fibrosis also results in pulled up cecum (FIGURE 8)

FIGURE: 8

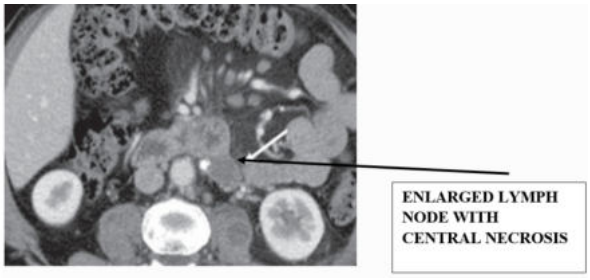


Lymph node involvement is very common with Intestinal tuberculosis, and at times is the only sign of disease. As the small bowel is commonly involved, its corresponding draining lymph nodes, the mesenteric, celiac, porta hepatis, and peripancreatic lymph nodes are commonly involved. On contrast-enhanced CT scan four types of contrast patterns have been described by Pombo et al [10] in abdominal tuberculosis:

1. Peripheral rim enhancement with hypodense centres.
2. Inhomogeneous enhancement,
3. Homogeneous enhancement and
4. Non-enhancing nodes

Besides, also commonly encountered in patients of abdominal tuberculosis is conglomerate of lymph node masses with areas of necrosis secondary to perinodal inflammation, increased number (>3 in one CT section) of mesenteric nodes and even calcified nodes at times. However, neither the nodal attenuation values nor the patterns of enhancement are characteristic of tuberculosis. Characteristic appearance of caseous lymph node, enlarged lymph node with hypoattenuation in the centre and hyperattenuation in the periphery, after intravenous contrast injection [11] is considered pathognomic of tuberculosis (Figure:9)

FIGURE: 9



The CECT Scan features suggestive of Peritoneal tuberculosis are:

1. Thickening of the peritoneum and mesentery which could be either nodular or symmetrical.
2. Abnormal enhancement of the peritoneum or mesentery
3. Enlarged lymph nodes with low attenuation.
4. Ascites

In the wet type variant, there is ascites which could either be free or loculated. Either way, this ascites shows high attenuation. The dry type is characterized by thickened cake like omentum, caseous lymphadenopathy and fibrous adhesions. In the fibrotic type there is presence of matted bowel loop along with omental caking and loculated ascites. (FIGURE 10,11)

FIGURE 10

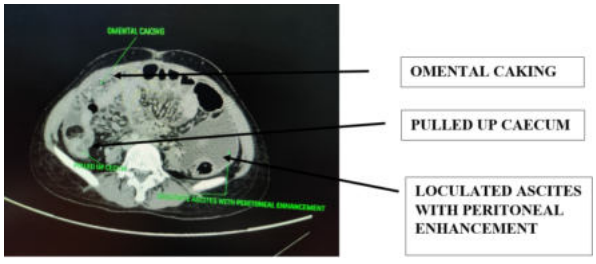
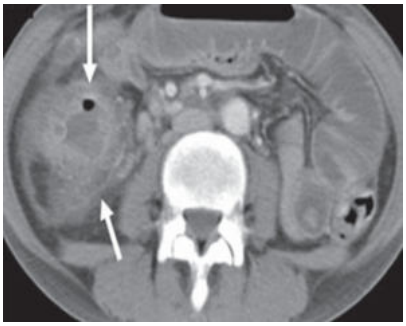


FIGURE 11



THICKENING OF PARITIES, STRICTURING OF TERMINAL ILEUM WITH PERICAECAL INFLAMMATION

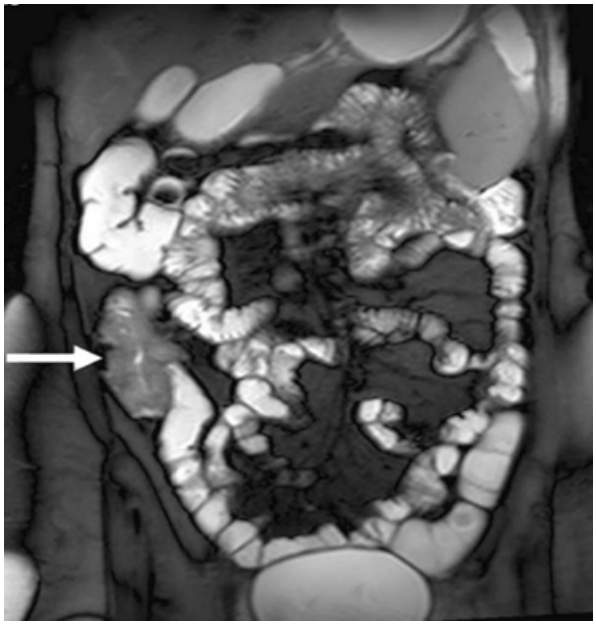
4.Magnetic Resonance Imaging:

MRI of abdomen has a limited role in evaluation of pathology of bowel. This is because of the artefacts caused by intestinal peristalsis, breathing and long acquisition time. However recent advances in the technology of MRI have helped in successfully overcoming these shortcomings. MRI not only provides good anatomic evaluation of bowel loops but importantly also helps in its functional evaluation with an added advantage of avoiding exposure to ionizing radiation.

For an MRI to delineate the bowel, it requires the bowel to be adequately distended. This can be achieved by MR enterography [12], using a gadolinium-based intravenous contrast agent. Cine imaging, a technique in which multiple frames about 20, are obtained for each slice position, which can be reviewed in the cine mode, is of help in obtaining functional information. This enables detection of adhesions, stenosis and dilatation [13].

Classically the affected bowel wall in T1-weighted images shows a decreased signal intensity compared to normal bowel. (FIGURE 12,13)

FIGURE: 12



T1 FAT SUPPRESSED PRE-CONTRAST IMAGE SHOWING ILEOCECAL THICKENING

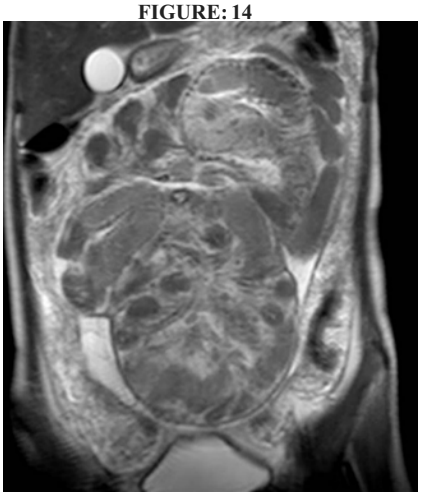
FIGURE: 13

T1 FAT SUPPRESSED PRE-CONTRAST IMAGE SHOWING ILEOCECAL THICKENING WITH PULLING UP OF CAECUM

In comparison on T2-weighted images shows a slightly increased, heterogeneous signal intensities [14]. T2-weighted sequences are very sensitive for detecting inflammation of the bowel loop more so with

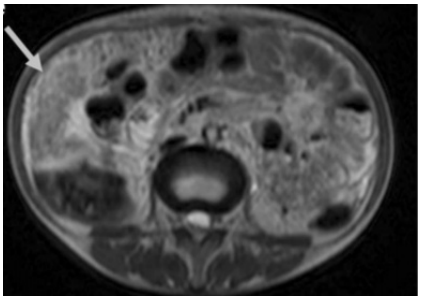
negative oral contrast agents. (FIGURE 14,15).

FIGURE: 14



T2 IMAGE SHOWING CLUMPED BOWEL LOOPS WITH EARLY 'CACOONING' AND LOCULATED ASCITES

FIGURE: 15



T2 IMAGE SHOWING OMENTAL CAKING WITH MULTIPLE OMENTAL NODULE

Though MRI as imaging modality for diagnosis for Intestinal tuberculosis is not performed as commonly as CECT Scan, it does have ad following advantage over CECT Scan:

1. Not much radiation hazard. This is because even without contrast as compared to CT, diagnostic information is obtained.
2. Dynamic cine MRI information provides functional assessment of the bowel loops

Summary:

Of all the investigations, CECT scan is the modality of choice for diagnosis of abdominal tuberculosis. This is because it not only gives a definite diagnosis but also helps in evaluating the extent and type of abdominal tuberculosis [15,16,17]. Besides, CT scores over MRI, it being a cheaper investigation with better spatial resolution, lesser artefacts and one which can simultaneously evaluate chest, abdomen and pelvis in a single examination. However, the advantage of MRI over CT is that it has no radiation hazard, which is of relevance in young patients. Also, its superior soft tissue resolution gives much more information even without contrast as compared to CT. Another advantage of MRI is its ability to do functional assessment of the bowel loops obtained by dynamic cine MRI.

A word of caution for treating clinician, is to keep in mind that most of the radiological findings are not specific [18] and needs to be complemented either by a microbiological or histopathological confirmation [19]. At times, even with availability of newer imaging technologies, the diagnosis of abdominal tuberculosis cannot be made with certainty, necessitating histopathological confirmation by diagnostic laparoscopy or a mini laparotomy. This is in keeping with the new criteria for diagnosis of abdominal tuberculosis as suggested by Lingenfelser[20] which includes:

1) Clinical manifestations suggestive of TB
2) Imaging evidence indicative of abdominal TB
3) Histopathological or microbiological evidence of TB and/or
4) Therapeutic response to treatment.

CONCLUSION:

Radiological imaging has an important role, second to none in the diagnosis of abdominal tuberculosis, which in turn helps in institution of timely treatment. USG, Barium studies, CECT Scan and MRI, owing to the characteristic features, helps in determining the diagnosis of abdominal tuberculosis. The choice of investigation to be performed is dictated by various factors including whether it is an isolated intestinal affection of TB or whether it is associated with Pulmonary TB, whether functional assessment of the bowel needs to be determined, renal function and availability of the investigation.

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