Computerized Tomography Features of Abdominal Tuberculosis

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ABSTRACT

Objective: To describe CT findings of abdominal tuberculosis (TB) because CT has the ability to demonstrate changes in the abdomen and is increasingly used for primary evaluation of abdominal conditions.

Methods: The abdominal CT images of 33 patients with proven abdominal TB in Siriraj Hospital from January 2005 to December 2009 were retrospectively reviewed. The CT findings of ascites, peritoneum, lymph node, gastrointestinal and visceral organ involvement were evaluated.

Results: The peritoneal and lymph node involvement were the most common features (78.8% of each finding). Peritonitis with ascites (wet type) was more common than dry type. Most of the patients with lymph node involvement had multiple groups (96.2%) and the most common location was mesenteric region. The gastrointestinal tract involvement was likely to be the combination of large bowel and small bowel diseases and the most common feature was bowel wall thickening (88.2%). The solid organ involvement was found about 20.4% which was always the part of multiple organs involvement or disseminated disease. The lymph node involvement in the immunocompromised group was statistically significantly different when compared with the non-immunocompromised group. (p 0.001)

Conclusion: CT scan is a reliable imaging modality to demonstrate abnormality in the abdominal cavity. The common features in the patients with abdominal tuberculosis include the combination of peritoneal, lymph nodes and multiple organs involvement. Diagnosis of abdominal tuberculosis is sometimes difficult to rely on CT features, so interpretation of images with the clinical and laboratory data could be a valuable tool in the diagnosis of abdominal tuberculosis, especially in patients with non-specific abdominal symptoms. Early and accurate diagnosis leads to an effective therapy and good prognosis with decrease of mortality rates.

Keywords: Computed tomography, abdominal tuberculosis

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INTRODUCTION

Abdominal tuberculosis is an important disease in Thailand. It is increasingly found in developed countries, mainly in patients with AIDS/HIV infection and in other groups of immunosuppressed population. The disease may involve any system in the body in which involvement in the abdomen can mimic many conditions, including malignancy such as lymphoma or carcinomatosis peritonei, inflammatory bowel disease, and other infectious diseases. Early and accurate diagnosis of abdominal TB leads to an effective therapy and good survival rates. On the contrary, untreated or delayed treatment leads to high mortality rates. Therefore it is necessary to early recognize the disease then initiate treatment for this curable disease.

Abdominal TB may present in varying imaging features depending upon the involved organs. Nowadays, CT offers the unique ability to image the entire abdominal structures within a single examination and is widely available. It is therefore important to be familiar with the CT appearances and complications of the disease. This retrospective study describes the CT features of abdominal TB with pathologically proven cases.

MATERIALS AND METHODS

The retrospective study was approved by our institutional review board. Between January 2005 and December 2009, the patients with proven abdominal TB who had undergone CT scans of the abdomen as part of their diagnostic work up, were included in the study. The
cases (Table 1). The most common clinical presentation of HIV infection and pulmonary TB was found in 15/33 patients, with the mean age about 46.12 years. The majority of the patients had HIV infection which accounted for 69.70%. In this cohort, none of the patients was on immunosuppressive drug or steroid. The patients with pulmonary tuberculosis were 63.64% and the combination of HIV infection and pulmonary TB was found in 15/33 cases (Table 1). The most common clinical presentation was abdominal pain which accounted for 20/33 cases (60.6%). Other symptoms were fever, abdominal mass, weight loss and one patient presented with high grade bowel obstruction. In this study, 22 patients had the evidence of abdominal tuberculosis by the histological evidence of caseating granuloma or demonstrable acid fast bacilli in the tissue or ascitic fluid (criteria a or b), 16 patients had the evidence of positive mycobacterium tuberculosis on culture (criteria c) and 9 patients had positive tests of both histology and culture. Four other patients had no records of positive histopathology results or culture and had satisfactory therapeutic response to anti-TB drugs. The sites of abdominal involvement have been shown in Table 2 in which the most common sites were peritoneal and lymph node involvement.

In 26 patients with peritoneal involvement, the CT analysis of the pattern of the peritoneal involvement was classified as “wet peritonitis” when ascites were present and as “dry peritonitis” when ascites were absent. The wet type was more common than the “dry” type (88.46% and 11.54%, respectively). The density of ascites was measured 6-33 HU in range (mean 16.1 H.U.).

### RESULTS

The patient’s cohorts were 33 patients, composed of 20 males and 13 females. The range of age was 20-79 years old, with the mean age about 46.12 years. The majority of the patients had HIV infection which accounted for 69.70%. In this cohort, none of the patients was on immunosuppressive drug or steroid. The patients with pulmonary tuberculosis were 63.64% and the combination of HIV infection and pulmonary TB was found in 15/33 cases (Table 1). The most common clinical presentation was abdominal pain which accounted for 20/33 cases (60.6%). Other symptoms were fever, abdominal mass, weight loss and one patient presented with high grade bowel obstruction. In this study, 22 patients had the evidence of abdominal tuberculosis by the histological evidence of caseating granuloma or demonstrable acid fast bacilli in the tissue or ascitic fluid (criteria a or b), 16 patients had the evidence of positive mycobacterium tuberculosis on culture (criteria c) and 9 patients had positive tests of both histology and culture. Four other patients had no records of positive histopathology results or culture and had satisfactory therapeutic response to anti-TB drugs. The sites of abdominal involvement have been shown in Table 2 in which the most common sites were peritoneal and lymph node involvement.

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### TABLE 1. Immune status and active pulmonary tuberculosis of the patients.

<table>
<thead>
<tr>
<th>Active pulmonary TB</th>
<th>Unknown</th>
<th>HIV Positive</th>
<th>HIV Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>2</td>
<td>15</td>
<td>4</td>
<td>21 (63.64%)</td>
</tr>
<tr>
<td>Negative</td>
<td>3</td>
<td>8</td>
<td>1</td>
<td>12 (36.36%)</td>
</tr>
<tr>
<td>Total</td>
<td>5 (15.15%)</td>
<td>23 (69.70%)</td>
<td>5 (15.15%)</td>
<td>33</td>
</tr>
</tbody>
</table>

### TABLE 2. CT features in abdominal tuberculosis patients.

<table>
<thead>
<tr>
<th>CT findings</th>
<th>No. patients</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peritoneal involvement</td>
<td>26/33 (N=33)</td>
<td>78.8%</td>
</tr>
<tr>
<td>No ascites (dry type)</td>
<td>3/26</td>
<td></td>
</tr>
<tr>
<td>Presented ascites (wet type)</td>
<td>23/26</td>
<td></td>
</tr>
<tr>
<td>density of ascites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 10 HU</td>
<td>4/23</td>
<td></td>
</tr>
<tr>
<td>10-20 HU</td>
<td>15/23</td>
<td></td>
</tr>
<tr>
<td>More than 20 HU</td>
<td>4/23</td>
<td></td>
</tr>
<tr>
<td>Lymph node involvement</td>
<td>26/33 (N=33)</td>
<td>78.8%</td>
</tr>
<tr>
<td>Mesenteric group</td>
<td>24/26</td>
<td></td>
</tr>
<tr>
<td>Paraortic group</td>
<td>21/26</td>
<td></td>
</tr>
<tr>
<td>Ileo-cecal group</td>
<td>9/26</td>
<td></td>
</tr>
<tr>
<td>Porta hepatic group</td>
<td>8/26</td>
<td></td>
</tr>
<tr>
<td>Iliac group</td>
<td>11/26</td>
<td></td>
</tr>
<tr>
<td>Solid organs</td>
<td>22/33 (N=33)</td>
<td>66.7%</td>
</tr>
<tr>
<td>Liver</td>
<td>15/22</td>
<td></td>
</tr>
<tr>
<td>Spleen</td>
<td>14/22</td>
<td></td>
</tr>
<tr>
<td>Kidney</td>
<td>9/22</td>
<td></td>
</tr>
<tr>
<td>Adrenal gland</td>
<td>2/22</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal tract</td>
<td>17/33 (N=33)</td>
<td>51.5%</td>
</tr>
<tr>
<td>Terminal ileum</td>
<td>12/17</td>
<td></td>
</tr>
<tr>
<td>Small bowel</td>
<td>6/17</td>
<td></td>
</tr>
<tr>
<td>Ileo-cecal valve and cecum</td>
<td>9/17</td>
<td></td>
</tr>
<tr>
<td>Colon</td>
<td>4/17</td>
<td></td>
</tr>
</tbody>
</table>
The pattern of peritoneal disease revealed peritoneal thickening in 25/26 cases; 96.2% (Fig 1C). This pattern was more common than peritoneal nodule (5/26 cases; 19.2%) and omental cake: plaque or mass like lesion (2 cases; 7.7%). The location of disease was found to be generalized in the abdominal cavity and the common locations were paracolic region (80.8%) and omentum (61.5%).

The lymph node involvement was detected in 26/33 cases (78.8%). Twenty five of 26 patients (96.2%) had multiple groups of node involvement. Localized or regional adenopathy was seen in only 1/26 case (3.8%) involving the mesenteric region.

Lymph node enlargement was seen in all patients with nodal involvement (100%) which was mostly matted appearance. Central necrosis was found in 22/26 cases (Fig 2) and calcification was found in only one case. The most common location of the lymph node involvement was mesenteric group, 92.3% followed by para-aortic group, 80.8% and iliac group, 42.3%.

The gastrointestinal tract disease was noted in 17/33 cases (51.5%). The location of disease involvement has been described in Table 2. The majority of the cases had the combination of small bowel and large bowel diseases accounting for 9/17 cases, 52.9%, followed by isolated small bowel involvement (8/17, 47.1%). The terminal ileum was the most common location of gastrointestinal tract disease (12/17; 70.6%). No isolated stomach or isolated large bowel disease was shown.

The gastrointestinal tract disease revealed wall thickening in 15/17 cases (88.2%) (Fig 3), obstruction in 4/17 cases (23.5%) and one patient with jejunal perforation.

The solid organ disease occurred in 22/33 cases (66.7%). The liver and spleen involvement could be seen as organomegaly or focal/multifocal hypodensity lesions (Fig 4A). The adrenal gland showed enlargement in one patient. Renal involvement was seen as multifocal hypodensity lesions (Fig 4B). The combination of the solid organ diseases was seen in 12/22 cases (54.5%) involved
TABLE 3. Abdominal TB features on CT in immunocompro-
mise (HIV/AIDS) and immunocompetent patients.

<table>
<thead>
<tr>
<th>CT features</th>
<th>HIV Positive (%)</th>
<th>HIV Negative (%)</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peritoneum involvement</td>
<td>73.9%</td>
<td>80.0%</td>
<td>1.000</td>
</tr>
<tr>
<td>Lymph node involvement</td>
<td>95.7%</td>
<td>20.0%</td>
<td>.001</td>
</tr>
<tr>
<td>Gastrointestinal tract</td>
<td>60.9%</td>
<td>20.0%</td>
<td>.153</td>
</tr>
<tr>
<td>Solid organs involvement</td>
<td>73.9%</td>
<td>60.0%</td>
<td>.606</td>
</tr>
</tbody>
</table>

in varying combinations. The isolated solid organ involve-
ment without other features was not found in this study.

DISCUSSION

Causative organisms for abdominal TB are
usually mycobacterium tuberculosis or mycobacterium
avium – intracellularis, the latter being more common in
immunocompromised patients. Abdominal TB is usually
carried by injection of the organism in infected sputum
or contaminated food. The mycobacterium tuberculosis
organism causes caseation necrosis in the intestine, fol-
lowed by spreading to mesenteric lymph nodes. In this
study, two of the most common findings were peri-
toneal and lymph node involvement, seen in 26/33 cases
(78.8%) each. The combination of CT features such as
lymphadenopathy, peritoneal, gastrointestinal tract or
solid organ involvement was seen in 30/33 (90.9%) cases.
Only 3 patients had isolated CT findings, two of which
had isolated peritoneal involvement and another one had
isolated lymph node involvement.

Peritonitis was more likely to be wet type than
dry type and the volume of ascites was small. Ascites in
abdominal TB can be transudate ascites due to an early
stage of immune reaction or complicated ascites (fluid
with septation or debris) due to a late stage of immune
reaction or cell mediated immunity.2 Ultrasound (US) is
a good modality to evaluate the complex nature of ascites
whereas it is difficult to demonstrate by CT.3 However,
CT is useful in determining the density of the ascitic fluid,
especially high density ascites which are presumably due
to the complex nature of the fluid. The high density of
the fluid has been reported to be specific for TB1,4 whereas
another5 suggested that it was not a reliable factor and can
overlap with peritoneal carcinomatosis or other abdominal
inflammatory processes. This study showed variability
of ascitic fluid density with a range of 6-33 HU. We
divided the range of density into 3 subgroups, consisting
of density less than 10 HU, 10-20 HU, and more than 20
HU. The most common subgroup was 10-20 HU (61.5%),
which meant that the majority of ascites in abdominal
tuberculosis, were not clear fluid. Mesenteric disease is
an important and common manifestation of early stage
abdominal TB. The mesentery is initially thickened with
a few discrete lymph nodes interspersed within it and,
the later stage of mesenteric disease represents irregular
inflammatory masses of caseating lymph nodes.7 CT of-
fers the distinct advantage of demonstrating these features
better than US because the bowel gas may alter visualization
of the mesentery on US.

In this study, the abdominal lymphadenopa-
thies were found in 78.8% of cases which commonly
involved the mesenteric region, followed by para-aortic
and iliac regions and mostly occurred in multiple groups.
These results are similar to the previous study in which
the lymphadenopathies involved mesenteric, portal and
peripancreatic sites reflecting the lymphatic drainage of
the small bowel.8 The lymph node characteristics, are
usually matted together with hypodense center or central
necrosis, probably due to caseation, and many occasionally
contain calcification.9,10 Although central necrosis with rim
enhancement of lymph node is not pathognomonic, it is
a useful sign and readily seen in the current generation
of CT scanners. Our study found central necrotic nodes
about 84.6% and calcific node in only one patient (3.8%).

The most common sites of gastrointestinal tract
TB are terminal ileum and cecum.11-14 Gastrointestinal tract
TB may be ulcerative type, hyperplastic type or a combi-
nation of the two. The ileocecal TB is often hyperplastic
type.15 In the early stage of the disease, circumferential
wall thickening of the cecum and terminal ileum and a
few regional nodes are seen. In later stages of the disease,
the ileocecal value and adjacent medial wall of the cecum
are predominantly and symmetrically thickened. However,
these changes are nonspecific and may also be seen in
cecal carcinoma, Crohn’s disease, lymphoma and amebia-
sis. In advanced ileocecal disease, there are gross wall
thickening, adherent small bowel loops, large regional
lymph nodes and mesenteric thickening together forming
a complex mass of varied density, which are characteristic
of CT appearance of TB. In this study, we also found the
terminal ileum as a common site with wall thickening. One
patient had jejunal perforation. There was no case of iso-
lated colonic, gastric and duodenal TB in this study which
had been documented as rare entities. Barium examination
is one of the best modalities to evaluate mucosal change
of the bowel, although evaluation of extramucosal disease
is limited. Thus, CT is valuable in evaluating directly the
extramucosal component of the disease.

Visceral TB is rarely seen in isolation, but more
frequently in parts of multi-organs or disseminated dis-
ease.2,10-18 Liver and spleen are the mainly involved organs
and the patterns can occur in the form of micro abscesses
in miliary TB, which is represented by CT as diffuse low
density focal lesions or in the form of larger abscesses.
This study found visceral TB in 22/33 cases (66.7%) similar
to other studies9,20 and the common feature was organomegaly and small abscess (63.6%). No calcified
granuloma was visible.

In this study, the authors tried to describe the
difference of CT features in immunocompromised and
immunocompetent patients. We had only HIV/AIDS
infection patients in the immunocompromised group.
We found that the lymph node involvement in the
immunocompromised group was more common than the
immunocompetent group (P<0.05) which was statisti-
cally significant whereas the peritoneal, gastrointestinal
tract and solid organ involvement showed no significant
difference. (Table 3)

In addition, we found pulmonary TB in 21/33
cases (63.64%) and the combination of TB and HIV/
AIDS was found in 15/33 cases (45.5%). The limitation of this study was the difference in number of patients in the two subgroups. We found abdominal TB in the immunocompromised patients more than immunocompetent patients, although this might reflect the association between abdominal TB and immune status.

**CONCLUSION**

CT scan is a reliable imaging modality to evaluate abdominal tuberculosis and to demonstrate the variety of abnormal findings in the whole abdomen. The common features in the patients with abdominal tuberculosis include the combination of peritoneal and lymph nodes involvement, solid organs involvement and gastrointestinal tract involvement, respectively. The radiologist may suspect abdominal TB in patients with systemic illness and abdominal symptoms when there is evidence of peritoneal disease, lymph node or several organs involvement. Although there is no only one characteristic CT feature to diagnose the disease, interpretation of CT images along with clinical and laboratory data can be a valuable tool to make the diagnosis of abdominal tuberculosis especially in immunocompromised patients. Last, early and accurate diagnosis leads to an effective therapy and good prognosis with decrease of mortality rates.

**REFERENCES**


