CT of Abdominal Tuberculosis

B. M. Epstein1,2
J. H. Mann1

Intraabdominal tuberculosis (TB) presents with a wide variety of clinical and radiologic features. Besides the reported computed tomographic (CT) finding of high-density ascites in tuberculous peritonitis, this report describes additional CT features highly suggestive of abdominal tuberculosis in eight cases: (1) irregular soft-tissue densities in the omentum area; (2) low-density masses surrounded by thick solid rims; (3) a disorganized appearance of soft-tissue densities, fluid, and bowel loops forming a poorly defined mass; (4) low-density lymph nodes with a multilocular appearance after intravenous contrast administration; and (5) possibly high-density ascites. The differential diagnosis of these features include lymphoma, various forms of peritonitis, peritoneal carcinomatosis, and peritoneal mesothelioma. It is important that the CT features of intraabdominal tuberculosis be recognized in order that laparotomy be avoided and less invasive procedures (e.g., laparoscopy, biopsy, or a trial of antituberculous therapy) be instituted.

We have recently had the opportunity to study eight patients with very unusual clinical and radiologic features whose diagnosis proved to be abdominal tuberculosis (TB). The radiologic features of abdominal TB have been well described [1–3], but these have concentrated on the plain film and barium studies. To our knowledge there is only one report of the computed tomographic (CT) findings of abdominal TB in the English literature [4].

Subjects and Methods

Eight patients aged 6–40 years were examined over a period of 18 months in the Radiology Department, Baragwanath Hospital. Baragwanath Hospital serves a population of about 1 million blacks of poor socioeconomic status in the Johannesburg area. The patients were an unselected group referred for evaluation of obscure abdominal pain, ascites, and abdominal masses, fever, and weight loss. Salient clinical features are depicted in table 1. The average duration of symptoms was 1 month. Most patients were referred for CT evaluation after an inconclusive sonographic examination.

All examinations were done with an Ohio Nuclear 2020 body scanner at 120 kV, 75 mA, scan time of 2 sec, and the gantry in neutral position. Slices 1 cm thick at 1.5–2 cm intervals were obtained through the area of interest. All patients (except case 1 who was extremely ill) received oral contrast material (2% Gastrografin and water); four patients were studied with intravenous contrast material given as a bolus using 60 ml of 60% methylglucamine iothalamate (Conray, Maybaker).

Results

The results of CT examinations of eight patients with abdominal TB are summarized in table 1. Six of the eight patients had evidence of high-density ascites (15–30 HU) on their scans.

Case 1 showed a very bizarre appearance with an extensive mixture of high-
<table>
<thead>
<tr>
<th>Case No. (age, gender)</th>
<th>Presenting Problems</th>
<th>Laboratory Investigations</th>
<th>Positive Radiologic Findings</th>
<th>CT of Abdomen</th>
<th>Confirmatory Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 (37, M)</td>
<td>2 weeks of weight loss, night sweats, fever, and abdominal pain. 3 cm hepatomegaly. Tender right abdomen. Patient refused hospital treatment. Returned 5 months later, same symptoms.</td>
<td>...</td>
<td>Sonogram: Anechoic masses in retroperitoneum.</td>
<td>Extensive low-density retroperitoneal, peripancreatic, porta hepatic, splenic hilar, and celiac axis masses.</td>
<td>Laparotomy: Caseous granulations throughout abdomen. Histology of omental biopsy: Miliary TB granulomata. Resolution of mass on anti-TB chemotherapy.</td>
</tr>
</tbody>
</table>
TABLE 1: Continued

<table>
<thead>
<tr>
<th>Case No. (age, gender)</th>
<th>Presenting Problems</th>
<th>Laboratory Investigations</th>
<th>Positive Radiologic Findings</th>
<th>CT of Abdomen</th>
<th>Confirmatory Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (14, M)</td>
<td>Bilateral flank pain and wasting for 3 months. Hematuria and burning on micturition for 1 week. Lymph node and axillary adenopathy, pyrexia.</td>
<td>Hb: 8.8 g/dl. ESR: 33 mm/hr. Urine microscopy: Red and white blood cells and scanty acid-fast bacilli.</td>
<td>Urogram: Nonfunctioning left kidney, filling defects in bladder. Sonogram: Anechoic masses with fine echoes in paraaortic and porta hepatic areas. Enlarged left kidney with dilated calices filled with echoes.</td>
<td>Hydroureteric left kidney with high-density fluid in calices. Low-density nodes with rim enhancement, in pelvic, paraaortic, peripancreatic, porta hepatic, retrocrural, celiac axis, and splenic areas.</td>
<td>Gradual improvement of symptoms on anti-TB chemotherapy. Left nephrectomy planned after 6 months of treatment.</td>
</tr>
</tbody>
</table>

Note.—ESR = erythrocyte sedimentation rate. LUG = left upper quadrant; LLL = left lower lobe; RUL = right upper lobe.

Fig. 1.—Case 1. Through mid abdomen. Disorganized appearance of soft-tissue densities, fluid and bowel loops posterior to distended transverse colon. Aorta poorly visualised. Mottled soft-tissue densities anterior to transverse colon in omental area (arrow).

and low-density structures in the mesenteric and retroperitoneal areas posterior to a distended colon (fig. 1). Despite the patient’s inability to ingest oral contrast material, these features were believed to represent a combination of tuberculous glands, ascites, adherent bowel, and granulomatous masses. This was subsequently confirmed at laparotomy.

Two patients (cases 2 and 3) showed large low-density masses with thick irregular peripheral rims (fig. 2). This appearance was believed to represent large caseous granulomatous masses and all the masses resolved on long-term anti-TB therapy.

Case 4 revealed large irregular omental masses interspersed within omental fat (fig. 3) accounting for the highly echogenic mass on sonographic examination. This, in combination with the high-density ascites and distorted ascending colon, was thought to represent the omental cake of TB peritonitis and was confirmed by laparoscopy and biopsy.

Four patients (cases 1, 2, 4, and 5) had evidence of omental involvement. This was exhibited as some increased distance and soft-tissue irregularity between the abdominal wall and bowel (fig. 4). Case 5, in addition, showed irregular soft-tissue densities in the mesentery.

Case 6 had a low-density ovoid lesion with a thick, well defined rim on CT (fig. 5) believed to represent a pyogenic subdiaphragmatic abscess. Laparotomy revealed caseating TB granulomata and a TB abscess containing acid-fast bacilli.

Two patients (cases 7 and 8) had low-density lymph nodes with rims (fig. 6). Case 8, in addition, had a hydroureterohydronephrosis with high-density fluid (10-20 H) in the calices (fig. 7). There was extensive involvement of all abdominal node-bearing areas in both of these patients. Neither patient had evidence of ascites.

Diagnosis was obtained by laparotomy in three patients and biopsy in two patients. Three patients were confidently diagnosed as abdominal TB on clinical and CT findings with subsequent resolution on long-term anti-TB therapy.

Discussion

Gastrointestinal TB may radiographically mimic a large variety of conditions such as: esophageal stricture with dysphagia, gastric ulcer or carcinoma, pyloric or duodenal obstruction, intraabdominal mass resembling carcinoma of the pancreas or lymphoma, intestinal malabsorption and protein-losing enteropathy, small-bowel stricture, ileoceleal masses, colonic carcinoma, ulcerative colitis, Crohn disease, peritoneal involvement, abdominal abscess, or fistula.

The radiologic features pertinent to barium examinations have been well described in most of those disorders, and some of the features may be characteristic for TB or may suggest the possibility of TB in the differential diagnosis [1, 3, 5]. However, the intraabdominal mass, peritoneal involvement, and abscess types of presentations may prove to be a more difficult diagnostic problem. The involvement of the intraabdominal and mesenteric lymph nodes could be demonstrated radiologically by lymphangiography [6]. However, most of these lymphangiographic and radiologic features
The pathogenesis of TB of the gastrointestinal tract is generally believed to be due to swallowing of a massive dose of TB bacilli which later pass into the tubular glands of the intestinal mucosa where an inflammatory exudate is produced. The overlying mucosa may be cast off with the formation of an ulcer. The consequence of these mucosal ulcerations is either an attempt at healing by fibrosis or spread. The bacilli may be carried from the submucosal lesions to the mesenteric lymph nodes that drain that segment of bowel, thereby producing caseous lymph nodes with abscess formation. The other possible routes of infection of the gut are by hematogenous and/or lymphatic spread and also by direct spread from the serosa by conti-

Pathophysiology of Radiologic Features

The pathogenesis of TB of the gastrointestinal tract is generally believed to be due to swallowing of a massive dose of TB bacilli which later pass into the tubular glands of the intestinal mucosa where an inflammatory exudate is produced. The overlying mucosa may be cast off with the formation of an ulcer. The consequence of these mucosal ulcerations is either an attempt at healing by fibrosis or spread. The bacilli may be carried from the submucosal lesions to the mesenteric lymph nodes that drain that segment of bowel, thereby producing caseous lymph nodes with abscess formation. The other possible routes of infection of the gut are by hematogenous and/or lymphatic spread and also by direct spread from the serosa by conti-
nuity from adjacent glands or structures. It is not believed that TB involvement of the bowel occurs by way of the peritoneum [5].

TB peritonitis is believed to be the result of rupture of mesenteric lymph nodes that were seeded by the hematogenous route from a primary pulmonary lesion. Other postulated routes of involvement are by direct extension or by hematogenous or lymphatic routes. Rarely, TB peritonitis is the result of genitourinary infection. However, in a series of 90 cases, Auerbach [7] did not find a single case of rupture of a mesenteric node and in over 50% of cases, the primary site is not demonstrable clinically or radiographically [8].

Three types of TB peritonitis are generally recognized [7, 9]. There is a wet type, with ascites or pockets of loculated fluid, a dry form with caseous nodules and adhesions creating a "plastic" abdomen, and a third form in which the omentum is greatly thickened and drawn together by fibrosis to form a thick, roughly triangular mass suspended from the colon and stomach in the mid abdomen. This mass is often palpable on physical examination and often is mistaken for a neoplastic process.

In the largest series of cases of intraabdominal TB, Bhan-
sali [3] described 300 cases of which, at operation, 196 were found to involve the alimentary canal; in the other 104 cases, only the lymph nodes and/or the peritoneum were affected.

Cases 1–6 are all examples of various presentations of TB peritonitis. Cases 1 and 6 represent the abscess type and cases 2 and 4 represent the mass type of presentation. Six cases had high-density ascites (15–30 HU) which pointed to the possible diagnosis of peritoneal TB. The ascitic fluid in these six cases were all exudates containing numerous lymphocytes. The differential diagnosis of high-density ascites would be related to the exudative content of the fluid [4] and thus would include some cases of malignant ascites and other types of peritonitis.

Case 1 had the disorganized appearance of an admixture of soft-tissue densities, fluid densities, and bowel loops. The differential diagnosis on the CT appearance could be widespread lymphoma (where one would expect to see a more homogeneous mass appearance) and peritoneal carcinomatosis (rare in children and without involvement of the retroperitoneal structures). Cases 2 and 3 had large pelvic and/or abdominal masses with a rim of solid tissue and central low-density areas representing the caseation necrosis. The differential diagnosis in these cases could be either ovarian masses (when limited to the pelvis) or lymphoma, particularly Burkitt lymphoma [10]. However, such low-den-
sity areas within lymphomatous masses would be very unusual unless there was extensive necrosis, particularly after radiation therapy [11].

Another feature, noted in cases 1, 3, and 5, that we believe may prove to be fairly specific in the diagnosis of peritoneal TB was irregular, small, soft-tissue densities in the omental area indicating omental involvement. Similar appearances have been described in peritoneal mesothelioma [12] and in omental tumor deposits, particularly in ovarian carcinomatosis [13], but in these cases the clinical presentation would differ markedly from peritoneal TB.

Case 4 had a large irregular omental mass, high-density ascites, and mesenteric nodes, a combination we believed to be fairly specific for TB. However, the omental mass or 'cake' appearance has been reported in peritoneal carcinomatosis, peritoneal mesothelioma, and theoretically can occur in any form of peritonitis [5]. This type of presentation conforms to the third type of TB peritonitis described above.

Case 6 had the nonspecific appearance of a subphrenic abscess, and the multiple TB granulomata were too small to be seen with present CT scanners. One other important differential diagnosis of tuberculous peritonitis is any form of peritonitis, whether idiopathic, postoperative, or in pseudomyxoma peritonei [14].

Cases 7 and 8 had low-density nodal masses and rim enhancement with intravenous contrast medium producing a multiloculated appearance. Low-density lymph nodes have been described in Whipple disease [15] and patients who have had chemotherapy, probably the result of necrosis [11]. Although we have studied only two patients with this type of presentation, we believe that this appearance will prove to be characteristic of TB nodes with caseation necrosis.

In conclusion, we have pointed out some CT features that we believe may prove to be of value in the diagnosis of some forms of intraabdominal TB. In view of the protean clinical presentations of abdominal TB, its ability to mimic other diseases, and the difficulty of diagnosis by other radiologic procedures, we believe that CT should play an early role in the diagnosis of this disease, particularly in endemic areas or areas with large Asian immigrant populations.

REFERENCES