

Computerized Tomography Findings of Abdominal Tuberculosis: Report of 19 Cases

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Abstract

Background: Abdominal tuberculosis usually presents with general symptoms and obscure abdominal complaints for which computerized tomography is often the first imaging study.

Objective: To evaluate the CT findings of abdominal tuberculosis.

Methods: The CT scans of 19 patients (10 men and 9 women aged 20–85 years) with proven abdominal tuberculosis were retrospectively reviewed to define the location and extent of the disease. The patients were referred for the study mainly with general systemic symptoms. Additional abdominal complaints were present in four, including acute abdomen in one. Two had symptoms deriving from the urinary tract. Nine patients had recently arrived from high prevalence countries; five of them and two others were positive for human immunodeficiency virus. Three patients had a family history of tuberculosis; one had previously been treated for tuberculosis and four others had an underlying chronic disease. The diagnosis of tuberculosis was established by standard microbiological and histological techniques.

Results: We divided the disease manifestations into intraperitoneal (n=13) and genitourinary involvement (n=6). Peritoneal tuberculosis was fairly common, characterized by ascites, omental and mesenteric infiltration, and smooth thickening of the parietal peritoneum. One oncology patient had a false positive Tc-99m CEA isotope scanning, suggesting tumor recurrence. Genitourinary disease manifested mainly as hydronephrosis and calcifications. Three patients had pulmonary tuberculosis as well.

Conclusion: The CT findings of abdominal tuberculosis may mimic various diseases, mainly diffuse peritoneal malignancy. We emphasize the need to consider tuberculosis in the differential diagnosis in patients with obscure abdominal symptoms, especially with multi-organ involvement. A high degree of clinical suspicion and familiarity with the abdominal CT manifestations allow early diagnosis of this treatable disease.

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Abdominal tuberculosis is relatively common in underdeveloped countries. However, it is increasingly found in developed countries, mainly in patients with AIDS and in other groups of immunosuppressed populations. It weakens cell-mediated immunity due to malnutrition, alcohol abuse, chronic illness, aging, malignancy and immunosuppressive therapy. The disease is also common among recent immigrants from high prevalence regions [1,2].

The clinical presentation and the imaging findings are often non-specific and may mimic other diseases. Even the skin test is frequently unreliable and the diagnosis may be difficult to establish. A high index of suspicion, especially in high risk populations, is necessary to make the correct diagnosis. Abdominal TB has a good prognosis if promptly diagnosed and treated [2]. Since CT is often requested for various abdominal complaints, its findings may arouse the suspicion of abdominal TB and thus the radiologist may be the first physician to suggest this diagnosis. We describe here the CT findings in 19 adults with proven abdominal TB.

Material and Methods

The clinical data and imaging studies of 19 patients with abdominal TB diagnosed on CT were retrospectively reviewed. These patients were diagnosed during a period of 12 years (1 January 1988 – 31 December 1999) at two medical institutions. One patient has been partially described previously in a series of duplex kidneys with associated complications [3].

The study group included 10 men and 9 women whose ages ranged from 20 to 85 (mean age 47.7 years). The patients were most often referred for an abdominal CT with general systemic symptoms such as fever of unknown origin, night sweats, weight loss, loss of appetite, weakness and malaise. Three of them had specific abdominal symptoms including abdominal pain and distension. One HIV-infected patient presented with acute abdomen. Disseminated intraperitoneal disease involving the colon with perforation was found at laparotomy, and he died a few days after surgery. Two patients had symptoms deriving

TB = tuberculosis
HIV = human immunodeficiency virus

from the urinary tract. One otherwise asymptomatic patient was referred for a routine follow-up study due to known abdominal malignancy.

Nine of the 19 patients were recent arrivals from high prevalence countries (Ethiopia, Nigeria and the Philippines); 5 of them were positive for HIV. Another two patients with HIV had resided in Israel for many years. Three patients had a positive family history of TB, and one HIV-positive Ethiopian immigrant had been partially treated for TB several years earlier.

Associated diseases were present in four patients: alcoholism, diabetes mellitus, red cell aplasia treated with high dose steroids, and malignant tumors of both the colon and the endometrium, respectively. Two patients died; the others recovered following therapy.

CT scans were obtained on an Elscint (Israel) 2400 Elite or an Elscint CT Twin with 10 mm collimation and 1.0 cm interval from the diaphragm to the symphysis pubis. All patients received orally diluted water-soluble contrast material, 1,000 ml administered over 2 hours before the examination and an additional 250 ml just before the study. Intravenous contrast (80–100 ml) of Urografin® (sodium-diatrizoate, Schering, Germany) or Telebrix (meglumine-ioxitalamic, Guerbert, France) was manually injected by bolus in all, except in one patient with renal failure related to the retroperitoneal disease.

The diagnosis of TB was established by the finding of acid-fast bacilli and/or a positive acid-fast stain, a positive culture of tubercle bacilli, or by the finding of a caseating granuloma on biopsy. All abdominal CT studies were reviewed retrospectively, especially for the presence of the following findings:

- abnormalities indicating peritoneal involvement: ascites, omental infiltration (fine or massive), peritoneal thickening and mesenteric involvement (moderate infiltration or masses)
- bowel wall thickening, indicating gastrointestinal involvement
- splenomegaly and splenic or hepatic focal lesions
- the presence and location of enlarged lymph nodes
- the presence of pathology in urogenital organs.

Results

We divided the patients according to involvement of the intraperitoneal organs (n=13) and genitourinary system (n=6). The distribution of the disease manifestations in the abdominal organs is shown in Table 1. All seven HIV-positive patients had intraperitoneal TB.

The CT findings revealed that ascitic fluid of water density was present in a variable amount in 10 patients (small to moderate in 7 and large in 2). Subtle infiltrative or bulky massive disease in the greater omentum was found in all patients [Figure 1] and in the mesenteric root in nine. Fine mesenteric thickening was seen in six, and coarse to massive infiltration in two. Eight patients had a smooth thickened parietal peritoneum. Five patients also had involvement of the bowel, four of the spleen and/or liver, and three had enlarged lymph nodes.

Table 1. Abdominal TB involvement in 19 patients

Diagnosis	No. of patients
Intraperitoneal	13
Ascites with additional abdominal organ involvement*	10
Omentum	10
Mesentery	9
Thickening of the parietal peritoneum	8
Bowel loops	5
Lymph nodes	3
Liver and spleen	2
Spleen	2
No ascites	3
Mesentery, splenomegaly	1
Omentum, mesentery, irradiated small bowel	1
Liver, spleen and lymph nodes	1
Genitourinary	6
Kidney/ureter	4
(1 with associated psoas abscess)	
Uterus + retroperitoneal lymph nodes	1
Male genitalia (seminal vesicles)	1
(with associated spinal osteomyelitis and splenomegaly)	

* There was usually more than one finding in every patient

Of the three patients without ascites, one HIV-infected patient had enlarged nodes in the neck and chest as well as splenomegaly and mild mesenteric infiltration. Another patient, with known endometrial and colonic malignancy, had minimal infiltrative changes in the omentum and mesentery with slight thickening of distal small bowel loops in the pelvis within an area that had received radiation therapy. A subsequent positive Tc-99m CEA scan suggested a high probability of recurrence. At surgery, however, biopsy established the diagnosis of TB and there was no evidence of recurrence of a malignant process. The patient remained well 17 months later after anti-tuberculous



Figure 1. A 75 year old man with a positive family history of TB presented with fever, abdominal distension, weakness and loss of appetite. Contrast-enhanced abdominal CT scan shows a small amount of ascites (arrow) and fine omental infiltration (arrowheads).

treatment. The third patient, also HIV positive, had enlarged nodes in the pelvis, groin and retrocrural region as well as hepatosplenic involvement, but no mesenteric or omental infiltration.

Splenic involvement was noted as splenomegaly with non-specific hypodense focal lesions, ranging from 3 to 12 mm in size, in three patients [Figure 2]. In two of them, associated focal hepatic lesions were also seen. Generalized homogeneous splenomegaly was found in three other patients, together with evidence of peritoneal TB in one and of genitourinary and spinal TB in another.

Liver involvement was seen as a single focal hypodense lesion (5 mm in size) in two patients, associated with splenic lesions in both of them.

Lymph node enlargement was found in four patients, with necrotic lymph nodes in one. Extraperitoneal (retroperitoneum or pelvic) lymphadenopathy was present in all four, associated with enlarged visceral lymph nodes in two of them. They all had additional intraabdominal manifestations of the disease.

The gastrointestinal tract showed pathology in six cases. In addition, ascites and omental or mesenteric masses were found in five of them. The colon was the most severely affected in one patient and was complicated by perforation, demonstrated by the leakage of the orally ingested contrast material on delayed images. Thickened small bowel loops and necrotic enlarged mesenteric nodes were also noted in that patient. Mural thickening of the sigmoid colon was seen in another patient. Small bowel loops were affected in another three patients, ranging from mural thickening of several loops to more extensive involvement. Minimal thickening of small bowel loops within an irradiated area was assumed to be enteritis changes due to irradiation in the fifth patient.

Genitourinary TB was demonstrated in six patients (36%), none of whom was positive for HIV. Four had evidence of TB involving the kidneys and/or the ureters. One of them had TB in a duplex kidney, with an obstructing ureteral stone in the ureter of the upper collecting system at the level of the pelvic inlet, associated with an ipsilateral psoas collection which was drained and proved to be a tuberculous necrotizing granulomatous inflammation. The upper-pole collecting system showed marked dilatation with significant parenchymal atrophy, while the lower-pole collecting system was slightly dilated due to ureteral compression by the psoas abscess. One patient, with a single collecting system, showed massive calcification in the non-excreting upper-pole parenchyma with mild atrophy of the parenchyma of the excreting lower pole. Another patient had marked hydronephrosis of the calyces of the right kidney with rim calcifications and severe parenchymal atrophy. In addition, moderate dilatation of the pelvis with preserved parenchyma of the lower pole of the kidney was seen, as well as dilatation of its draining ureter with localized thickening of the wall of the distal ureter [Figure 3]. Cystoscopy revealed hyperemic bladder mucosa around the patulous lower-pole ureteral orifice. Caseating granulomas were found on histological examination. The fourth patient had mild hydronephrosis and hydroureter up to



Figure 2. A 49 year old Ethiopian man, positive for HIV, with fever and night sweats. Multiple small hypodense splenic lesions and a slightly enlarged mesenteric node (arrow) are seen. On other cuts, bilateral retrocrural and pelvic lymphadenopathy was noted.



Figure 3. A 43 year old man with fever and night sweats. Contrast-enhanced CT at the pelvis shows the thickened wall of the distal ureter (arrowhead).

the level of the distal ureter, without demonstrable ureteral thickening.

The last two patients had TB in the genital organs. One male patient had involvement of the seminal vesicles in addition to tuberculous spondylitis and splenomegaly. He presented with fever of unknown origin and splenomegaly. Sequential pelvic CT studies disclosed enlarging seminal vesicles and prostate with the appearance of new perirectal and presacral infiltration within 3 weeks. A female patient had TB endometritis proved by curettage and biopsy. She presented with acute renal failure due to marked ureteral compression from bulky retroperitoneal lymph nodes. Additional CT findings in this case included a moderate amount of ascites, thickened pelvic fascia and mesenteric leaves, small pleural effusions and subcutaneous edema. These findings were assumed to be signs of volume overload secondary to the renal failure.

Active pulmonary disease was seen in four patients with peritoneal TB, manifested as multiple pulmonary nodules and mediastinal lymphadenopathy in one, as a large infiltration with cavitation in the left lower lobe in another, as fine miliary spread in the third, and as mediastinal and hilar lymphadenopathy in the fourth. Two other patients with extensive ascites fluid had a small amount of pleural fluid, unilateral in one and bilateral in the other, thought to be reactive fluid since there was no evidence of pulmonary disease.

Discussion

While the predominant form of TB is pulmonary disease, tuberculous infection occurs with increasing frequency in extrapulmonary locations [2]. After the initial hematogenous dissemination from pulmonary TB, the infection progresses to clinically silent granulomas. These granulomas may contain stable viable tubercle bacilli for years, which may reactivate when host-immune changes occur.

Regarding the CT findings, the most common manifestations of abdominal TB were ascites of a variable amount and omental infiltration, seen in 10 of the 13 patients with intraperitoneal disease. Eight patients also had smooth thickening of the parietal peritoneum. Lundstedt et al. [4] reported peritonitis in 40 of 112 patients (36%) with abdominal TB, and in 12 of 23 (52%) patients in another series [5]. The amount of ascitic fluid is variable depending on the type of peritonitis. TB peritonitis is commonly divided into three types. The “wet” type is the most common and is characterized by a large amount of free or loculated ascitic fluid; the “fibrotic-fixed” type is characterized by large omental and mesenteric masses and matting of bowel loops; and the “dry or plastic” type by mesenteric thickening, fibrous adhesions and caseous nodules [6–11]. There is considerable overlap between the first two types, and there were signs of both “wet” and “fibrotic-fixed” type in 8 of our 10 patients with TB peritonitis. The other two conformed to the “dry” type – the less common type of TB peritonitis. It has been suggested that ascitic fluid measuring higher than water density (25–45 HU) may be characteristic of TB due to the high protein and cellular content in the tuberculous exudate [7]. In our cases, however, the ascitic fluid was of near water density. The CT appearance of chylous ascites, i.e., a fat-fluid level in conjunction with caseated lymph nodes, has also been described to be pathognomonic for TB [12].

The CT findings of TB peritonitis are non-specific and mimic disseminated peritoneal malignancy, mesothelioma and non-tuberculous peritonitis [13]. The presence of a slight and smooth peritoneal thickening is more suggestive of TB, while nodular irregular thickening is more compatible with peritoneal carcinomatosis [14].

Recently, CEA-Scan has been reported to be a high quality rapid technique that uses an inexpensive and readily available radionuclide that adds significant information in assessing the extent and location of disease in metastatic or recurrent colorectal cancer [15]. The positive predictive value of this scan,

combined with conventional diagnostic modalities, has been reported to be 98% when both modalities show positive findings [15]. This test was used in only one case in our series and gave what proved to be a false-positive result.

Four of the 12 patients (30%) with TB peritonitis in our series had active pulmonary disease and 2 of them were HIV positive. In the literature, 15–20% of patients with peritoneal TB are reported to have concomitant active pulmonary disease [9], while TB peritonitis occurs in up to 3.5% of cases with pulmonary TB [6].

TB lymphadenitis is the most common manifestation of abdominal TB, with a reported incidence of up to 55–66% of cases [7,8,10,11]. Visceral lymph nodes are usually affected, and a central hypodensity within an enlarged node is regarded as characteristic but not pathognomonic [7,8,10]. Four of our 13 patients with intraperitoneal disease had lymphadenopathy, while one patient with genital TB presented with bulky retroperitoneal lymphadenopathy. Necrosis was seen in the HIV-positive patient who presented with acute abdomen due to extensive gastrointestinal involvement and colonic perforation. Disseminated abdominal disease with involvement of mesenteric lymph nodes, the peritoneum, solid visceral organs as well as the gastrointestinal tract – mainly the ileum and the colon – has been reported in TB infection in AIDS patients [8].

Hepatosplenic involvement is very common at autopsy in patients with disseminated disease but is usually not identified at clinical presentation. This is due to the generally miliary form of the infection with nodules ranging from 0.5 to 2 mm in size, which may not be detected on CT. Imaging findings usually demonstrate an enlarged liver and spleen that may contain multiple non-specific, low attenuation lesions. These hypodense foci mimic neoplastic, inflammatory and other infectious diseases [4,7,10,11]. A solitary hepatic lesions representing involvement of this organ was found in two of our patients; in addition both had multiple hypodense lesions within an enlarged spleen. Splenic involvement was manifested in our series by its enlargement and/or multiple intrasplenic small hypodense lesions.

TB of the gastrointestinal tract is rare, and when present is located in the ileocecal region and the right colon in 90% of cases [4,7,8,10–12]. The most common imaging finding is concentric mural thickening. However, we found more extensive bowel involvement with several small bowel loops affected in five patients. Additional extensive colonic involvement was found in one of these five, an HIV-positive patient presenting with bleeding and perforation. Sigmoid involvement was found in another.

Genitourinary tract involvement occurs in 18% of extrapulmonary TB and is associated with active pulmonary disease in 10% [7,14]. The CT findings of urinary tract tuberculous infection include renal calcifications in several forms that occur in more than 50% of cases. These include focal parenchymal lesions such as hypodense lesions, scars or cavities that communicate with the collecting system, and scarring and strictures within the collecting systems [7,10,11,16,17]. Char-

acteristic calcification in a lobar distribution, seen in one patient, is often found in end-stage disease [11]. Ureteral involvement occurs in nearly half of the patients, with thickening of the ureteral wall or strictures commonly found in the distal third, as seen in one patient. Hydronephrosis and hydroureter of variable degree and severity are common [10,11,16,17]. Regarding genital tract disease, tuberculous salpingitis occurs in nearly all women with genital involvement and may spread to cause peritonitis and endometritis, as found in one of our patients. In males, calcifications within the seminal vesicles or the prostate and hypodense lesions, representing caseous necrosis and inflammatory process, may suggest tuberculosis in the proper clinical settings. These findings, however, were non-specific and require further confirmation [7,10,11,16].

In conclusion, the clinical symptoms and signs of abdominal TB can be subtle and general. Since CT is often used for various clinical presentations in daily practice, the radiologist may suspect abdominal TB in patients with systemic and obscure abdominal symptoms, especially when there is evidence of peritoneal disease or involvement of several organs. A high index of suspicion is required mainly in patients with AIDS or in recent immigrants from high prevalence regions. If recognized and treated early, abdominal TB – a potentially lethal disease – has a very good prognosis.

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