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## Original Article

**Abdominal Tuberculosis in Children: A Diagnostic Challenge**Yo-Spring Lin<sup>a</sup>, Yhu-Chering Huang<sup>b\*</sup>, Tzou-Yien Lin<sup>b</sup><sup>a</sup>Department of Infectious Diseases, Ton-Yen General Hospital, Hsinchu, Taiwan.<sup>b</sup>Division of Pediatric Infectious Diseases, Department of Pediatrics, Chang Gung Memorial Hospital and Chang Gung University College of Medicine, Taoyuan, Taiwan.

**BACKGROUND/PURPOSE:** Abdominal tuberculosis (TB) is a rare manifestation of childhood TB. Abdominal TB is characterized by long-lasting abdominal symptoms, which are usually confused with other conditions, and the diagnosis is usually delayed.

**METHODS:** During a 5-year period, we identified 10 cases of abdominal TB in a tertiary care children's hospital. Data including demographic characteristics, presenting symptoms, history of Bacille Calmette-Guérin vaccination, lesion sites, laboratory data, image findings, diagnosis, tuberculin skin test, risk factors, treatment, and outcome were collected and analyzed.

**RESULTS:** There were six female patients and four male patients, with a mean age of 14.7 years. One patient died due to the complication of disseminated TB with a pneumothorax. Household members with TB could be traced in six (60%) patients. The most common clinical presentations included fever (9/10), abdominal pain (8/10), and weight loss (8/9). The diagnosis of abdominal TB was suspected initially in only three patients; the others were not diagnosed until 7–36 days (mean = 19 days) after hospitalization. The abnormal abdominal image findings, by either computed tomography or ultrasound, included lymphadenopathy (7/9), high-density ascites (6/9), thickening of the omentum or peritoneum (6/9), inflammatory mass (3/9), bowel wall thickening (1/9), and liver abscess (1/9). The chest radiography was abnormal in nine patients. *Mycobacterium tuberculosis* was isolated from ascites in two out of four patients, gastric aspirates in three, sputum in three, and intra-abdominal tissue specimens in two. Laparotomy was performed in three patients, laparoscopy in one, and colonoscopy in one.

**CONCLUSION:** In Taiwan, abdominal TB should be considered in patients with fever, abdominal pain, weight loss, and abnormal chest radiography. Characteristic computed tomography findings of abdominal TB and a history of exposure to TB contribute to the diagnosis.

**KEYWORDS:** abdominal tuberculosis, children, computed tomography, *Mycobacterium tuberculosis*, Taiwan

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## Introduction

Taiwan has a relatively high prevalence of tuberculosis (TB). Since the 1960s, the mortality rate and prevalence of TB have declined subsequent to mass vaccination with Bacille Calmette-Guérin (BCG) vaccine and the introduction of effective anti-TB drugs. However, the incidence of TB in Taiwan remains high, particularly in aboriginal people.<sup>1</sup> According to a report from the Center for Disease Control (CDC) of Taiwan in 2003, the incidence and mortality rate of TB was 66.7 and 5.8 per 100,000, respectively.<sup>2</sup>

Abdominal TB is thought to develop by hematogenous dissemination from a distant primary focus (usually the lung), or via lymphatic spread from diseased lymph nodes or solid organs. Abdominal TB is well described in adults, but is relatively rare in children in the modern era.<sup>3</sup> Abdominal involvement is uncommon in children, occurring with an incidence of approximately 10% under the age of 10 years,<sup>4</sup> with complicating pulmonary TB in 1–5% of cases.<sup>5,6</sup>

Abdominal TB may involve the gastrointestinal tract, peritoneum, lymph nodes and solid viscera, either individually or in combination. The disease can mimic many conditions, including inflammatory bowel disease, malignancy, and other infectious diseases.<sup>7,8</sup> Diagnosis is therefore often delayed.<sup>6</sup> This may not only result in mortality but also in unnecessary surgery.<sup>9</sup> The aim of this study was to describe the clinical and radiologic manifestations of childhood abdominal TB seen at a referral center in Northern Taiwan.

## Methods

The medical records from January 1998 to December 2002 of children less than 18 years of age with TB and managed in Chang Gung Children's Hospital, (which is located in Northern Taiwan and provides from primary to tertiary care), were retrospectively reviewed. Abdominal TB was identified in 10 children, representing 8.9% (10/112) of the pediatric TB cases at our hospital during the study period.<sup>10</sup> The diagnosis of TB was made based on a positive culture results, acid-fast staining, histopathology, polymerase chain reaction, and clinical presentation.

Data including demographic characteristics, presenting symptoms, history of BCG vaccination (routine BCG

vaccination was administered within the first week of life), lesion site, laboratory data, image findings, diagnosis, tuberculin skin test, risk factors, treatment, and outcome were collected. Radiographs were interpreted by the pediatric radiologists. Tuberculin skin tests were done using the purified protein derivative (PPD) RT23 intradermal injection method (2 tuberculin units, 0.1 mL) and interpreted within 48–72 hours. An induration of 15 mm or more in children with BCG vaccination, or an induration of at least 10 mm in those without BCG vaccination, was interpreted as positive. The number of days to diagnosis was recorded as the number of days to the day on which the laboratory studies for TB were recorded.

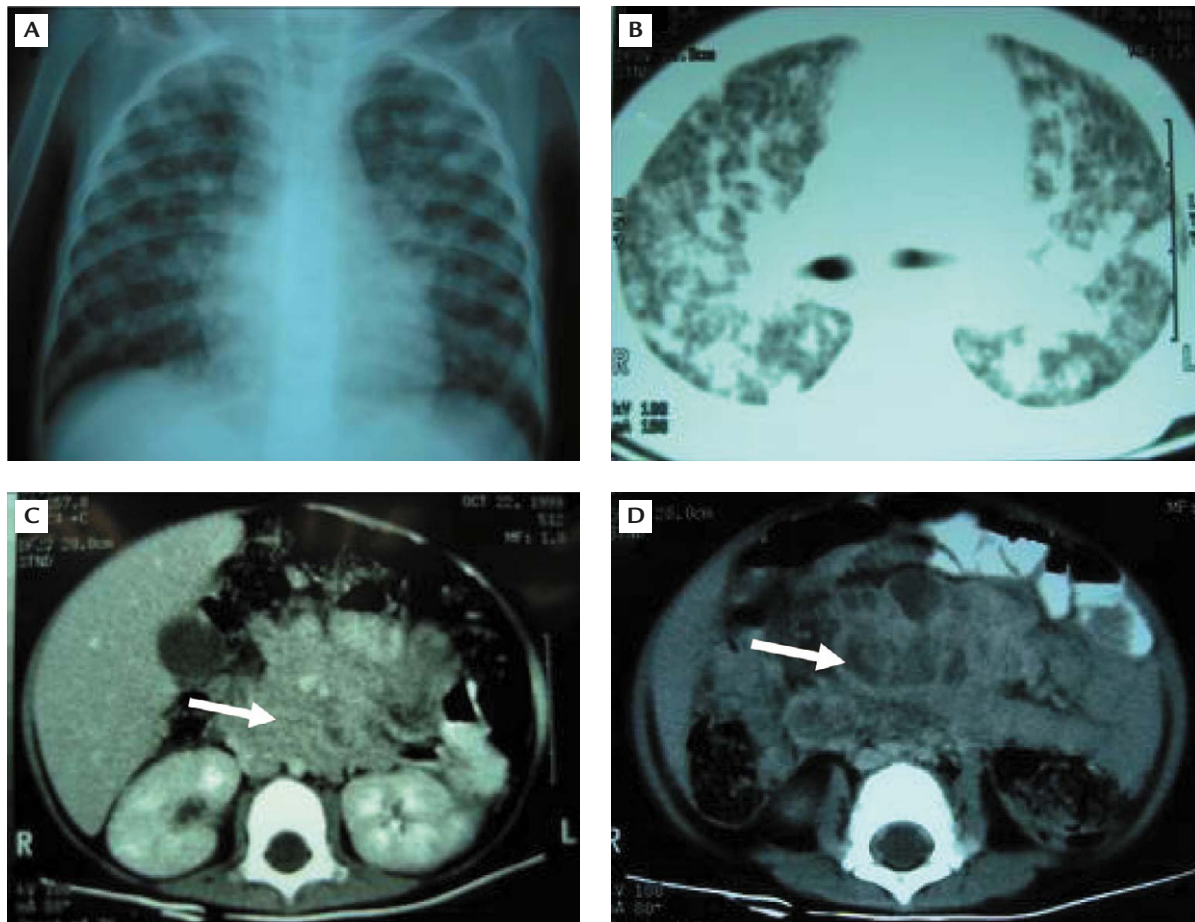
## Results

Of the 10 patients studied, four were male and six were female. The mean age was 14.7 years, and only one patient was younger than 10 years old. Household members with TB could be traced in six (60%) patients. One patient was an aboriginal and had not received BCG vaccination previously. Underlying chronic conditions were identified in four children and included thalassemia minor (case 1), systemic lupus erythematosus (case 2), asthma (case 7), and ventricular septal defect (case 8).

### *Clinical presentations*

The most common presentations included fever (9/10), abdominal pain and/or discomfort (8/10), and weight loss (7/8). Two patients had no gastrointestinal complaints initially (cases 6 and 7). Three patients had constipation, but none had diarrhea. Two patients had chronic presentation with persistent symptoms for more than 6 weeks, seven presented as subacute, with symptoms persisting for 2–6 weeks, and one presented as acute, with symptoms for less than 1 week. The mean duration of symptoms before hospitalization was 26 days.

A diagnosis of abdominal TB was suspected initially in only three patients, who had the characteristic miliary pattern (Figure) or a cavity on chest radiography. For the other seven patients, a diagnosis of abdominal TB was not made until 7–36 days (mean = 19 days) after hospitalization. The initial diagnoses in these seven cases included fever of unknown origin, ovarian cysts, suspicious malignancy, acute appendicitis, intra-abdominal abscess, systemic



**Figure.** Chest X-ray and computed tomography scan of a girl aged 2 years and 9 months old who was admitted with high fever and cough for 2 weeks. (A) Chest X-ray and (B) chest computed tomography show multiple variable-sized nodular lesions scattered in both lung fields and enlarged lymph nodes in the right paratracheal and peribronchial, subcarinal regions and pericardial region. (C) Abdominal computed tomography showed mesentery thickening. (D) Abdominal computed tomography showed a rim enhancement nodular mass at the conglomerated pre-vertebral, superior mesentery artery axis, suggesting lymphadenopathy with central necrosis.

lupus erythematosus, constipation, and functional gastrointestinal disorder.

None of the patients had a history of TB. All 10 patients had TB disease involving sites other than the abdomen, including the lung in eight children, the pleura in five, and the meninges, pericardium, and cervical lymph nodes in one each (Table).

### **Radiologic findings**

Chest X-rays were abnormal in nine patients, of whom only two had a cough. All eight patients examined with computed tomography (CT) had abnormal findings, and abnormal abdominal ultrasounds were recorded in six patients. The abdominal CT features included lymphadenopathy (7 patients; Figure), high-density ascites (7), thickening of the omentum or peritoneum (6), inflammatory

masses (3), bowel wall thickening (1), and solid organ involvement (1).

### **Laboratory findings**

*M. tuberculosis* was isolated the ascites in two patients, from intra-abdominal tissue specimens in two, from gastric aspirate in three, and from sputum in three. Consistent histopathological findings were noted in all five patients who received surgical interventions for diagnosis. TB polymerase chain reaction was positive in two samples. A reactive tuberculin skin test (induration > 15mm) was noted in one of the six patients tested.

The mean white blood cell (WBC) level of all cases on admission was  $11.92 \times 10^9/L$  (ranging from  $4.60 \times 10^9/L$  to  $19.20 \times 10^9/L$ ), the mean platelet count was  $411 \times 10^9/L$  (ranging from  $210 \times 10^9/L$  to  $630 \times 10^9/L$ ), and the mean

Table. Clinical presentation of 10 children with abdominal tuberculosis

Case	Age (yr)	Sex	Clinical presentations involved	Abdomen organ(s) involved	Other organ(s) intervention	Surgical	Hospital stay (d)	Delay diagnosis (d)	PPD test (mm)	Household TB history (Y/N)	Chest X-ray finding	Evidence of TB infection
1	15.4	M	Prolonged fever for 2 wk, abdominal pain, weight loss	Liver	Pleura	Laparotomy	56	26	15	N	Infiltration with PE	TB-PCR (abscess), histopathology (abscess)
2	17.3	F	Prolonged fever for 2 wk, abdominal pain	Ascites, omentum mesentery	Pleura	-	23	13	10	N	PE	TB culture (pleura)
3	13.2	F	Abdominal pain for 2 mo	Ascites, mesentery, lymph nodes	Lung	-	0 <sup>a</sup>	7	-	N	Cavitations	TB culture (bronchial washing)
4	12.3	M	Abdominal pain for, 1 mo fever for 3 wk	Mesentery, lymph nodes, intestine	Lung	Laparotomy	40	37	-	Y	-	TB culture (sputum, gastric aspiration, tissue), histopathology (tissue)
5	17.2	F	Abdominal fullness for 2 wk	Ascites, omentum, peritoneum, mesentery, lymph nodes	Lung	Laparoscopy	13	12	<10	Y	PE	TB culture (ascites), histopathology (tissue)
6	2.8	F	Intermittent fever for 2 wk, cough	Mesentery, lymph nodes	Lung	-	46	0	<10	Y	Miliary pattern	TB culture (sputum), acid fast stain (sputum, gastric aspiration)
7	17.6	F	General weakness with weight loss 20 kg in 2 mo	Colon	Lung, CNS	Colonoscopy	19	2	<10	Y	Cavitations	TB culture (sputum, gastric aspiration, CSF, tissue, urine), acid fast stain (sputum, gastric aspiration, tissue, urine), histopathology (tissue)
8	17.5	M	SOB and fever for 2 d, cough	Ascites, lymph nodes	Lung, pleura, pericardium	-	28	28	-	N	Hilar adenopathy	TB-PCR (ascites)
9	10.7	M	Abdominal pain for 3 wk, fever for recent 5 d	Ascites, omentum, mesentery, lymph nodes	Lung, pleura	Laparotomy	17	7	<10	Y	Infiltration with PE	TB culture (ascites, pleural fluid), histopathology (tissue)
10	11.1	F	Cough and abdominal pain for 1 mo, fever, weight loss	Ascites, mesentery, lymph nodes	Lung, pleura, neck lymph nodes	-	10	0	-	Y	Miliary pattern	TB culture (gastric aspiration, urine), acid fast stain (gastric aspiration)

<sup>a</sup>Diagnosis and treatment at outpatient department without hospitalization. PPD = Purified protein derivatives; Y/N = yes/no; PE = pleural effusion; TB = tuberculosis; PCR = polymerase chain reaction; CSF = cerebrospinal fluid; SOB = shortness of breath; CNS = central nervous system.

serum C-reactive protein concentration was 107 mg/L (ranging from 42 mg/L to 182 mg/L; normal, <5 mg/L). Ascites specimens were obtained for analysis in three cases, showing a mean WBC of  $0.88 \times 10^9/L$ , a mean glucose level of 70 mg/dL, and a mean protein level of 4.5 mg/dL. The tumor marker, CA-125, was checked in two cases and was found to be 1,150 U/mL and 461 U/mL. A human immunodeficiency virus test was done in three cases and all were negative.

### **Treatment and outcome**

One patient (case 8) died from the complications of disseminated TB to the lung, pericardium, and peritoneum with a pneumothorax. Drug resistance to streptomycin was noted in only one patient (case 10). The other nine patients were started on triple or quadruple anti-TB therapy comprising rifampicin (10–15 mg/kg/day), isoniazid (10–15 mg/kg/day), pyrazinamide (20–30 mg/kg/day), and ethambutol (15 mg/kg/day) for 2 months, and then maintained on double anti-TB therapy for 10–13 months.

### **Discussion**

In this study, household members with a history of TB were identified in 60% of the children.<sup>11</sup> These results suggest that most children, especially those of young age or with a severe clinical presentation, acquired the infection within the household. Fever, abdominal pain/discomfort and weight loss were the most common symptoms found in this study, which is similar to previous reports.<sup>11–13</sup> In some reports, abdominal distention/mass, and ascites were the most common presenting symptoms, while fever was relatively uncommon.<sup>11,14</sup> These symptoms usually persisted for weeks to months before the patients sought medical help, and a diagnosis of abdominal TB was made.<sup>6,11</sup> Chronic presentation, with symptoms persisting for more than 6 weeks (accounting for 63% of the patients), was most common in the study reported by Muneef et al.<sup>12</sup> In this study, a subacute presentation with symptoms noted for 2–6 weeks, was the most common. One explanation for this difference may be that national health insurance covers at least 96% of the population in Taiwan and it is very easy for the patients to seek medical attention.

All 10 patients in our study had extra-abdominal TB, which is consistent with previous reports, and most had

pulmonary and pleural involvement.<sup>6</sup> This is an indicator for the diagnosis of abdominal TB. Abdominal imaging studies, including ultrasound and CT, have important roles in the diagnosis of abdominal TB.<sup>11,13</sup> Most of the cases in previous reports that received abdominal imaging had abnormal findings and the common findings included high-density ascites, intra-abdominal/mesenteric lymphadenopathy, omental/mesenteric/bowel wall thickening, solid organ involvement, and an abdominal/inflammatory mass seen in our study.<sup>11,15</sup> However, these findings are generally nonspecific. Previous reports indicate that CA-125, a tumor marker, is elevated in cases of abdominal TB.<sup>16</sup> In this study, CA-125 was measured in two patients, and both had an abnormally high value. Whether CA-125 is a good marker for abdominal TB needs further evaluation.<sup>17</sup>

Diagnosis of abdominal TB is a challenge to clinicians. The clinical manifestations are nonspecific, last for weeks to months, and have varied presentations that may mimic a variety of other abdominal disorders.<sup>6,18,19</sup> Abdominal imaging, performed subsequently in most cases, usually reveals abnormalities, but these findings are also nonspecific.<sup>20</sup> Unless a high index of suspicion is maintained, the diagnosis can easily be missed or delayed, resulting in increased morbidity and mortality.<sup>21</sup> As shown in this series, the diagnosis of abdominal TB was initially suspected in only three cases, and in the remaining seven patients (70%) the diagnosis was made at least 7 days after hospitalization.

In TB endemic areas, like Taiwan, abdominal TB should be considered in patients with nonspecific constitutional symptoms and long-lasting abdominal symptoms.<sup>22</sup> In addition to confirmatory tests for TB, including the tuberculosis skin test or PPD test,<sup>6,13</sup> TB interferon-diagnostic tests<sup>23</sup> and mycobacterial tests, chest radiography and abdominal image studies should be performed to avoid delays in treatment. The response to therapeutic anti-TB medication may indirectly confirm the diagnosis.<sup>14,22</sup> Surgery is reserved for tissue diagnosis and the management of complications.<sup>24,25</sup>

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