amphotericin B are adequate to eradicate all viable *B. dermatitidis* when treating primary CNS blastomycosis. PCR analysis of specimens obtained during episodes of CNS blastomycosis could help differentiate between reinfection and reactivation.

On the basis of the recommendations for the treatment of primary CNS blastomycosis that were reported by Ward et al. [15] and the above-mentioned facts, we developed the following management strategy for this patient. First, surgically resect the mass and/or abscess. The initial use of CT-guided aspiration and amphotericin B was inadequate for treating CNS blastomycosis in this case. Second, after surgery, treat with liposomal amphotericin B. An empirical dose would range from 5 to 10 g. Third, continue long-term antifungal therapy with outpatient amphotericin B administration. For our patient, the total amphotericin B dose given was empirically doubled from that given in 1995. Fourth, follow the patient closely with physical examinations and brain scans (CT or MRI) 3 months after therapy is completed and every 6 months thereafter for at least 36 months. Physicians who encounter similar situations could tailor this information to the clinical situation they face.

**Ashish Chow\-\-lin,1 Robert Tight,1,2 and Steven Mitchell2**

1University of North Dakota School of Medicine and Health Sciences and 2MeritCare Health System, Fargo, North Dakota

### References


**Peritoneal Coccidioidomycosis: Case Report and Review**

Peritonitis is an unusual extrapulmonary manifestation of coccidioidomycosis. Peritoneal involvement often has an indolent course and may resolve spontaneously. Optimal management has not been defined; however, fluconazole's spectrum of activity, pharmacokinetic profile, and efficacy in dialysis-related yeast peritonitis suggest that it may be an effective treatment. To our knowledge, we report the first case of coccidioidal peritonitis treated with fluconazole and review the literature.

Less than 1% of individuals with coccidioidomycosis will develop extrapulmonary disease, which usually involves the skin, CNS, bones, or joints [1]. Almost any site may be infected; however, gastrointestinal tract involvement is rare. As for other diseases that are not reportable, the true incidence of this entity is probably underestimated. Coccidioidal peritonitis was first reported by Ruddock and Hope [2] in 1939. We identified 25 previously reported cases [2–10] (table 1); most of these patients were treated before the availability of azole antifungal drugs.

To our knowledge, we report the first case of coccidioidal peritonitis treated successfully with fluconazole and review the literature.

A 71-year-old white Canadian woman presented in May 1993 with a 2-month history of increasing abdominal girth associated with vaginal prolapse, anorexia, and a 5-lb weight loss. However, she denied abdominal pain, fevers, night sweats, and previous pneumonia. She had been successfully treated with chlorambucil and prednisone in 1991 for low-grade non-Hodgkin's lymphoma. She had spent the winters in Arizona during the previous 10 years.

Physical examination was notable for peripheral wasting and marked abdominal distension due to ascites. A chest radiograph revealed bilateral pleural effusions but no parenchymal disease. Paracentesis revealed turbid yellow ascitic fluid. Analysis of the fluid revealed the following: lactate dehydrogenase level, 805 U/L; glucose level, 4.6 mmol/L; protein level, 44 g/L...
Table 1. Clinical characteristics of 26 patients with coccidioidal peritonitis.

<table>
<thead>
<tr>
<th>Case [ref]</th>
<th>Age (y), sex, race or ethnicity</th>
<th>Presenting symptom(s); examination result(s) (underlying disease[s])</th>
<th>Diagnostic procedure(s); finding(s)</th>
<th>Positive specimens</th>
<th>CF antibody; precipitin titer(s)</th>
<th>Skin test*</th>
<th>Extraperitoneal involvement</th>
<th>Antifungal therapy; dose</th>
<th>Outcome, FU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 [2]</td>
<td>35, M, J</td>
<td>2 w of abdominal swelling, pain; ascites, low-grade fever (alcoholism)</td>
<td>Peritoneoscopic biopsy; peritoneal nodules, ascites (4 L)</td>
<td>Peritoneum, abdominal nodes, liver, spleen, kidneys, pleura</td>
<td>Peritoneal fluid, pleural fluid</td>
<td>NA; NA</td>
<td>NA</td>
<td>Pleural effusion, abdominal nodes, liver, spleen kidneys</td>
<td>None (CXR showed basal atelectasis)</td>
</tr>
<tr>
<td>2 [3]</td>
<td>48, M, W</td>
<td>6 w of abdominal swelling; ascites</td>
<td>Laparotomy</td>
<td>Peritoneum</td>
<td>NA</td>
<td>1:128; 1:10</td>
<td>Neg</td>
<td>None (CXR showed basal atelectasis)</td>
<td>AmB, 500 mg</td>
</tr>
<tr>
<td>3 [3]</td>
<td>30, M, W</td>
<td>Inguinal hernia</td>
<td>Herniorrhaphy; granular, nodular peritoneum</td>
<td>Peritoneum</td>
<td>NA</td>
<td>1:256; NA</td>
<td>Pos</td>
<td>None (neg CXR)</td>
<td>None</td>
</tr>
<tr>
<td>4 [4]</td>
<td>5, M</td>
<td>5 mo of abdominal swelling and inguinal hernia</td>
<td>Left herniorrhaphy; peritoneal nodules, ascites</td>
<td>Peritoneum</td>
<td>NA</td>
<td>1:256; NA</td>
<td>NA</td>
<td>None</td>
<td>AmB, 520 mg</td>
</tr>
<tr>
<td>5 [4]</td>
<td>37, M, J</td>
<td>&lt;1 mo of abdominal discomfort, swelling, inguinal hernia; ascites</td>
<td>Herniorrhaphy; ascites</td>
<td>NA</td>
<td>NA</td>
<td>1:256; NA</td>
<td>NA</td>
<td>Cavitated RUL nodule</td>
<td>AmB, 1958 mg</td>
</tr>
<tr>
<td>6 [4]</td>
<td>16, M, W</td>
<td>Inguinal hernia</td>
<td>Herniorrhaphy; ascites</td>
<td>Ascitic fluid (5300 mL); poss smear</td>
<td>NA</td>
<td>1:256; NA</td>
<td>NA</td>
<td>Right hilar infiltrate</td>
<td>None</td>
</tr>
<tr>
<td>7 [4]</td>
<td>48, F, B</td>
<td>3 w of abdominal pain, swelling, fever; ascites, fever</td>
<td>Paracentesis</td>
<td>NA</td>
<td>Neg guinea pig inoculation</td>
<td>1:128; NA</td>
<td>Pos</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>8 [4]</td>
<td>32, M, H</td>
<td>3 w of RLQ abdominal pain</td>
<td>Laparotomy, appendectomy</td>
<td>Appendix</td>
<td>NA</td>
<td>NA; NA</td>
<td>Neg</td>
<td>Minimal pulmonary infiltrate 5 mo before</td>
<td>NA</td>
</tr>
<tr>
<td>9 [4]</td>
<td>24, M</td>
<td>2 w of epigastric pain; ascites</td>
<td>Paracentesis (7 L of fluid from 2 procedures); cell count (48% eosinophils)</td>
<td>NA</td>
<td>Neg culture of ascitic fluid</td>
<td>1:4 (later 1:64); pos</td>
<td>Neg</td>
<td>Right pleural effusion, right paratracheal adenopathy</td>
<td>AmB, 2150 mg</td>
</tr>
<tr>
<td>10 [4]</td>
<td>35, M, W</td>
<td>Inguinal hernia</td>
<td>Herniorrhaphy; ascites</td>
<td>NA</td>
<td>Ascitic fluid</td>
<td>1:128; NA</td>
<td>NA</td>
<td>Pulmonary coccidiodymycosis 8 mo before</td>
<td>AmB, 2g</td>
</tr>
<tr>
<td>11 [4]</td>
<td>30, F, W</td>
<td>2–3 y of pelvic and rectal pain; cul-de-sac nodules</td>
<td>Hystereotomy; nodules on peritoneum, spleen, uterus, Fallopian tubes, appendix</td>
<td>Multiple (nodules from surgery)</td>
<td>Intra-abdominal nodules</td>
<td>1:16; NA</td>
<td>NA</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>12 [5]</td>
<td>34, M, B</td>
<td>Abdominal pain, diarrhea, anorexia, fever</td>
<td>Laparotomy; peritoneal nodules, ascites</td>
<td>Omentum</td>
<td>NA</td>
<td>1:128; NA</td>
<td>Neg</td>
<td>Pleural effusion, pneumonia</td>
<td>AmB</td>
</tr>
<tr>
<td>13 [5]</td>
<td>30, M, W</td>
<td>Abdominal pain and swelling</td>
<td>Laparotomy; peritoneal nodules, ascites</td>
<td>Omentum</td>
<td>NA</td>
<td>1:64; NA</td>
<td>Neg</td>
<td>Hilâr adenopathy</td>
<td>AmB</td>
</tr>
<tr>
<td>14 [5]</td>
<td>38, F, W</td>
<td>Abdominal pain</td>
<td>Paracentesis (culture of fluid)</td>
<td>NA</td>
<td>Peritoneal fluid</td>
<td>1:16; NA</td>
<td>Neg</td>
<td>Pleural effusion</td>
<td>None</td>
</tr>
<tr>
<td>15 [5]</td>
<td>36, M, W</td>
<td>Painful inguinal hernia</td>
<td>Herniorrhaphy; peritoneal fluid and granulomas on hernia sac</td>
<td>Omentum, hernia sac</td>
<td>Peritoneal fluid Omentum, hernia sac</td>
<td>1:128; NA</td>
<td>Neg</td>
<td>None</td>
<td>AmB</td>
</tr>
</tbody>
</table>
16 [5] 20, F, B Pelvic pain Laparotomy; tubo-ovarian abscess, peritoneal nodules Excised tissues; wet mount of ascitic fluid Peritoneum NA 1:16; NA Neg None None (surgical excision) NED, 10 y

17 [5] 16, M, W Painless abdominal swelling Laparoscopy; peritoneal nodules, ascites Laparotomy; retroperitoneal abscess NA NA 1:256; NA Neg None None NED, 2 y

18 [5] 7, M, B Abdominal (flank) swelling; fluctuant lumbar mass Laparotomy; retroperitoneal abscess NA Abscess material NA 1:128; NA Neg Pleural effusion; pneumonia, abscess, L4 vertebral lesion None (surgical drainage) Died of disseminated disease

19 [5] 25, F, B 2 d of pelvic pain, fever; pelvic mass Laparotomy; pelvic peritoneal adhesions, nodules Peritoneum, omentum NA NA; NA NA NA None NA NA

20 [6] 77, M, C Inguinal hernia (diabetes) Herniorrhaphy; granular, indurated omentum Omentum, hernia sac NA 1:16; neg NA None (5 mo before, chest wall mass [culture pos for Coccidioides immitis] and pneumonia resolved) None " NED, 1 y

21 [6] 28, M, J Inguinal hernia Herniorrhaphy; peritoneal nodules Peritoneum, hernia sac NA 1:1024; neg Pos None (pneumonia 17 mo before, when CF antibody titer was 1:64) Ket for 1 mo, then AmB, Ig NED, 7 mo.

22 [7] 21, M, W Abdominal swelling, and pain; tense ascites Laparotomy; chylous ascites (4 L), peritoneal nodules Peritoneum, nodes NA 1:16; pos Neg Small bowel, retroperitoneal node; pleural effusion (transudate, culture was neg) AmB, 4.25 g; then Ket for 2 mo (>400 mg/d), then Itr AmB therapy failed; then Ket; prompt response to Itr (FU, 18 mo) Died of hepatic encephalopathy, aspiration pneumonia

23 [8] 57, M Fever, abdominal pain and swelling (AIDS [CD4 count, 10 cells/mm³], diabetes, cirrhosis) Paracentesis; ascites NA Peritoneum, fluid, stool NA Pos Urine culture was pos (C. immitis pneumonia, meningitis 2 y before) AmB, 2 g Died of hepatic encephalopathy; aspiration pneumonia

24 [9] 42, M, W 3 w of abdominal swelling, anorexia, diarrhea; gross ascites (AIDS [CD4 count, <200 cells/mm³]) Laparoscopy; ascites, large white peritoneal plaques and nodules Peritoneum NA 1:128; NA NA None (undiagnosed perihiilar adenopathy? 7 mo before, resolved) AmB NED, 6 mo

25 [10] 30, M 3 mo of umbilical, inguinal swelling; umbilical and inguinal hernias Herniorrhaphy; thick, edematous hernia sac; pleural fluid a NA Peritoneum NA 1:256; NA NA None (neg CXR) ABCD Responded, NA

26 [PR] 71, F, W 2 mo of abdominal swelling, anorexia, vagina prolapse; gross ascites (previous non-Hodgkin’s lymphoma) Laparoscopy; peritoneal nodules; pleural fluid a NA Peritoneum, peritoneal fluid Neg (IDCF test); (neg EIA for IgM and IgG) Neg Pleural effusions (pleural fluid and biopsy specimen cultures were neg; histological analysis showed nonspecific inflammation) AmB, 2.2 g; then Flu, 400 mg/d for 4 mo and 200 mg/d for 4 mo NED, 5 y

NOTE: ABCD, amphotericin B colloidal dispersion; AmB, amphotericin B; B, black; C, Chinese; CF, complement fixation; CXR, chest radiograph; Fla, fluconazole; FU, follow-up; IDCF, immunodiffusion CF, H, Hispanic; Itr, itraconazole; J, Japanese; Ket, ketoconazole; NA, not available; NED, no evidence of disease; neg, negative; pos, positive; PR, present report; RLQ, right lower quadrant; ref, reference; RUL, right upper lobe; W, white.

a Skin test for coccidioidomycosis.
b AmB treatment was begun 3 mo after laparotomy, at a time when the patient was asymptomatic.
c Because of nephrolithiasis, Am B was not given intravenously but instead was applied topically to the chest wall lesion.
d WBC count, 4200 cells/µL (80% lymphocytes, 7% mononuclear cells, 7% neutrophils).
e WBC count, 141 cells/µL (57% neutrophils, 33% mononuclear cells, 7% lymphocytes).
Other comorbid conditions

Radiographic findings

and CSF were negative for C. immitis. Upon transfer to our hospital on 14 July 1993, her treatment was switched from amphotericin B to oral fluconazole (400 mg daily). Fluconazole treatment was associated with gradual clinical improvement, allowing hospital discharge on 19 August 1993. Cultures of peritoneal biopsy and fluid specimens obtained on 11 August 1993 were again positive for C. immitis; the fluconazole level in peritoneal fluid was 40 μg/mL (determined by bioassay). Repeated paracentesis was planned for November but was cancelled because the ascites had resolved. After 4 months of fluconazole therapy, the dosage was reduced to 200 mg daily and continued for another 4 months. A coccidioidin skin test was negative. Five years later, she was well without evidence of recurrent disease.

Cases of peritonitis due to C. immitis that were reported from 1966 to 1999 were identified through a MEDLINE search. Additional cases were identified from the list of references included in published reports.

The literature review identified 25 previously reported cases of coccidioidal peritonitis [2–10] (table 1). Other cases were excluded for the following reasons: description not sufficient in detail (13 of 21 cases [4]; 1 case [11]), autopsy cases (6 cases [12–15]), and a pathology series of 50,000 appendectomies (11 cases [16]).

Review of the 25 previously reported cases and our case showed a male predominance (20 [77%] of 26 cases). The median age of the patients was 31 years (range, 5–77 years). Of the 22 patients whose race or ethnicity was indicated, 12 (55%) were white, 5 (23%) were black, 4 (18%) were Asian, and 1 (4%) was Hispanic. The most common presenting complaints were abdominal swelling (12 patients [46%]), abdominal pain (10 [38%]), and inguinal or periumbilical hernia (9 [35%]); less frequent symptoms were fever (5 [19%]), pelvic pain (3 [12%]), flank mass (1 [4%]), and vaginal prolapse (1 [4%]). Physical examination revealed the presence of ascites in 11 patients (42%), pelvic mass or nodules in 2 (8%), and a lumbar mass in 1 (4%).

In 19 cases (73%), the diagnosis was established by demonstration of characteristic spherules of C. immitis. Three patients had spherules demonstrated by examination of a smear of peritoneal fluid (histological analysis was also positive for 2 of these patients). Four cases were diagnosed on the basis of positive cultures of peritoneal fluid (3) or abscess material (1). Three cases were diagnosed solely on the basis of positive serum serology and a compatible clinical presentation that included ascites (cases 5, 7, and 9). Overall, the following positive cultures were found: peritoneal (ascitic) fluid (6 patients), peritoneal biopsy specimens (defined as peritoneum, omentum, intra-abdominal nodules, or hernia sac; 5), pleural fluid (1), stool (1), urine (1), and abscess material (1) were positive. One or more positive cultures were reported in 10 (38%) of the cases.

CF testing was positive for 21 (91%) of 23 patients whose test results were available. The median CF antibody titer was 1 : 128 (range, negative to 1 : 1024). Coccidioidin skin testing was positive in 4 (25%) of 16 cases. Evidence of simultaneous extraperitoneal involvement with C. immitis was present in 11 (42%) of the cases (cases 1, 5, 6, 9, 12, 13, 14, 18, 22, 23, and 26). A history of remote coccidioidomycosis at sites other than the peritoneal cavity was suspected or documented in 5 (19%) of the cases (cases 8, 10, 20, 21, and 23).

Information regarding treatment was not specified in 2 cases.
Figure 1. Peritoneal biopsy specimen from a patient with peritoneal coccidioidomycosis; hematoxylin-eosin staining demonstrates a spherule of *Coccidioides immitis* within a granuloma (original magnification, ×400).

(cases 8 and 19). Of 10 patients (38%) who did not receive systemic antifungal therapy, 2 were treated surgically. Eight of these 10 patients had clinical resolution with a median follow-up of 2 years (7 spontaneously and 1 after surgery [case 16]). Of the 14 patients who received systemic antifungal therapy, 13 were treated with amphotericin B (8 responded, 4 had treatment failure, and 1 did not report a response); 1 patient treated with amphotericin B colloidal dispersion responded. The cumulative dose of amphotericin B was specified in 9 cases, ranging from 500 to 4250 mg (median, 2000 mg). Three of the amphotericin B–treated patients also received systemic azole therapy (cases 21, 22, and 26); responses to fluconazole and itraconazole, but not ketoconazole, therapy were reported. Four patients (cases 1, 12, 18, and 23) died; 3 died of disseminated coccidioidomycosis (2 of whom received no antifungal therapy [cases 1 and 18]), and 1 died of other causes. The median follow-up for the remaining 18 patients was 18 months (range, 2 months to 14 years).

The clinical presentation of peritoneal coccidioidomycosis ranges from indolent disease detected at the time of repair of inguinal hernia to an acute abdominal process with findings of peritoneal irritation. Although frequently absent, physical findings may include the presence of ascites, but fevers are usually absent or low grade. The operative findings typically include the presence of ascites and an inflamed peritoneum studded with nodular lesions suggestive of tuberculous peritonitis or carcinomatosis. Because the diagnosis is seldom suspected initially, demonstration of the spherules of *C. immitis* in biopsy specimens is the most frequent means of diagnosis. Fungal cultures and examination of smears of ascitic fluid and biopsy specimens are usually not initially considered.

The paucity of reported cases of peritoneal coccidioidomycosis makes it difficult to determine optimal treatment. Limited data from a small number of cases suggest that penetration of iv amphotericin B into peritoneal fluid is variable [17, 18]. The addition of intraperitoneal amphotericin B to systemic amphotericin B therapy in the management of fungal peritonitis in patients undergoing long-term ambulatory peritoneal dialysis has been suggested; however, practical considerations and the potential for increased peritoneal adhesions and fibrosis related to this route of drug delivery are problematic [19]. In contrast, 5-fluorocytosine [17] and fluconazole penetrate well into aque-
ous body compartments, including peritoneal fluid. For cases of peritoneal dialysis–related peritonitis due to yeast (i.e., non-filamentous fungi), fluconazole plus 5-fluorocytosine has been recommended as the initial treatment of choice [20].

Azole antifungals (fluconazole, itraconazole, and ketoconazole) may be indicated in the treatment of various forms of pulmonary coccidioidomycosis and are the usual drugs of choice for treatment of disseminated infection [21, 22]. Fluconazole has also emerged as the treatment of choice for treatment of disseminated infection [21, 22]. Fluconazole plus 5-fluorocytosine may be indicated in the treatment of various forms of fungemia and for yeast peritonitis related to long-term ambulatory peritoneal dialysis, and has its excellent penetration into peritoneal fluid; therefore fluconazole appears to be an attractive option for first-line therapy for coccidioidal peritonitis.

Peter Phillips¹ and Bryce Ford²
¹Division of Infectious Diseases, St. Paul’s Hospital, and ²University of British Columbia, Vancouver, British Columbia, Canada

References

Value of Quantitative Serology for Confirmation of Helicobacter pylori Eradication: An 18-Month Follow-Up Study

In this study several therapies were administered to 124 H. pylori–positive patients and IgG antibody titers were measured by ELISA at months 0, 2, 3, 6, 12, and 18 months. Serum titers of IgG antibody progressively decreased after H. pylori eradication; at 3 months, the area under the receiver operating characteristic curve for the decrease of IgG antibody titers for confirming H. pylori eradication was 0.99, with 100% sensitivity and 99% specificity (when the cutoff point was set at 3 U/mL). We conclude that a decrease in serum titers of IgG antibody to H. pylori relatively early after completion of therapy (1 month after ranitidine or bismuth therapy is completed and 2.5 months after antibiotic therapy is completed) can be used as a noninvasive, simple, and inexpensive method to confirm H. pylori eradication.

Helicobacter pylori is the main etiologic factor in chronic gastritis [1] and gastroduodenal ulcer disease [2], and its pres-

Informed consent was obtained from all patients.

Reprints or correspondence: Dr. Javier P. Gisbert, Playa de Mojarca 29, Urb. Bonanza, 28669 Boadilla del Monte, Madrid, Spain (gisbert@meditex.es).

Clinical Infectious Diseases 2000;30:976–80
© 2000 by the Infectious Diseases Society of America. All rights reserved.
1058-4838/2000/3006-0035$03.00