JOURNAL OF CLINICAL MICROBIOLOGY, Dec. 2003, p. 5827–5829 Vol. 41, No. 12
0095-1137/03/$08.00+0 DOI: 10.1128/JCM.41.12.5827–5829.2003
Copyright © 2003, American Society for Microbiology. All Rights Reserved.

Trichosporon inkin Peritonitis Treated with Caspofungin

Miguel G. Madariaga,* Allan Tenorio, and Laurie Proia

Rush Medical College and Cook County Hospital, Chicago, Illinois

Received 17 March 2003/Returned for modification 11 September 2003/Accepted 20 September 2003

***Trichosporon inkin* is one of six pathogenic species of the genus *Trichosporon* and the etiologic agent of pubic white piedra. *Trichosporon* species have been reported as a cause of disseminated infections, particularly among immunosuppressed patients. We describe the third reported case of *T. inkin* peritonitis associated with peritoneal dialysis and the first to be treated with caspofungin.**

CASE REPORT

A 49 year-old African-American woman with chronic renal failure secondary to focal segmental glomerulosclerosis on chronic ambulatory peritoneal dialysis (CAPD) presented to the Emergency Department with a 4-week history of intermittent fever, abdominal pain and distention, and cloudy peritoneal fluid. At 3 weeks prior to presentation she was admitted to another hospital, where a presumptive diagnosis of bacterial peritonitis was made. She received intraperitoneal vancomycin and gentamicin and was sent home after 4 days. Her symptoms persisted, and the intensity of the abdominal pain began to interfere with her daily activities. At 2 days before admission to our hospital, she developed nausea and vomiting.

The patient's past medical history was remarkable for hypertension and hypothyroidism. She had no prior episodes of peritonitis.

Physical examination on admission showed a mildly pale woman in moderate distress. Her temperature was 99.2°F, pulse was 110 beats per minute, respiratory rate was 20 breaths per minute, and blood pressure was 110/70 mm Hg. Her skin examination results, including her scalp and pubic hair, were normal. The results of examination of her head, lungs, and heart were normal. Her abdomen was slightly distended and diffusely tender, with no rebound or guarding and with normal bowel sounds. The Tenckhoff catheter site was clean and without evidence of erythema or discharge. There was no evidence of organomegaly. She had no lower extremity edema. Neurologic examination results were unremarkable.

Laboratory studies revealed a peripheral leukocytosis of 18.3 $\times$ 10^9 cells/liter with 75% neutrophils. Her ascitic fluid was hazy, with a white cell count of 1,610 cells/mm^3 and 53% eosinophils. The results of gram staining and aerobic culture of sediment from spun ascitic fluid were negative.

The patient was started empirically on piperacillin-tazobactam and vancomycin for presumptive bacterial peritonitis. However, given the elevated eosinophil count in ascitic fluid, a diagnosis of allergic peritonitis secondary to the Tenckhoff catheter was also considered.

On the second hospital day, growth of budding yeast in the ascitic fluid culture was reported. The Tenckhoff catheter was removed, and a central venous catheter was placed for hemodialysis. Intravenous (i.v.) administration of fluconazole (200 mg every 24 h [q24h]) was begun. The patient remained febrile and continued to complain of abdominal pain. Fluconazole was discontinued, and amphotericin B deoxycholate (0.7 mg/kg of body weight i.v. q24h) was given. During infusion of amphotericin B, the patient developed fever, severe rigors, and hypotension. She was transferred to the medical intensive care unit and started on i.v. fluids and vasopressors. Administration of amphotericin B was discontinued, and administration of caspofungin (70-mg i.v. loading dose; 50-mg i.v. q24h maintenance dose) was started.

The patient improved clinically over the next several days and was transferred to a general medical floor. At 1 week later, the yeast in the ascitic fluid was identified as *Trichosporon inkin* (determined with a carbohydrate utilization panel, api 20 C AUX; Biomerieux, Marcy-l'Etoile, France). The culture of the Tenckhoff catheter tip was also positive for growth of *T. inkin*. The patient completed a 14-day course of treatment with caspofungin. On the 15th hospital day, a new Tenckhoff catheter was inserted and CAPD was reinitiated. The patient was discharged home in good condition.

Susceptibility testing of caspofungin with our *T. inkin* isolate was performed (using National Committee for Clinical Laboratory Standards guidelines for broth microdilution antifungal susceptibility testing of yeasts) (17) on both RPMI 1640 and antibiotic medium 3 (AM3). Susceptibility testing for fluconazole was performed using RPMI 1640 medium only. Caspofungin and fluconazole drug stocks were supplied by the manufacturers as powders (caspofungin was supplied by Merck Research Laboratories, Blue Bell, Pa., and fluconazole was supplied by Pfizer Central Research, Sandwich, United Kingdom). MICs of caspofungin (defined as representing prominent [≥80%] or complete [100%] growth inhibition) were determined visually after 24 and 48 h of incubation. The MIC of fluconazole (defined as representing prominent [≥80%] growth inhibition) was determined visually after 48 h of incubation per National Committee for Clinical Laboratory Standards guidelines. MICs of caspofungin and fluconazole for our clinical *T. inkin* isolate are described in Table 1.

Discussion. Peritonitis is a major complication of CAPD, and although the overall incidence has declined, it still occurs at a rate of 0.5 episodes per year (26). Recurrent peritonitis is

* Corresponding author. Mailing address: Section of Infectious Diseases, Rush Medical College, 600 S. Paulina St., Suite 143, Chicago, IL 60612. Phone: (312) 942-2051. Fax: (312) 94-22184. E-mail: migmad@worldnet.att.net.

Downloaded from http://jcm.asm.org/ on December 4, 2020 by guest

TABLE 1. MICs of caspofungin and fluconazole for our clinical *T. inkin* isolate

Drug and medium	Growth inhibition (MIC [μg/ml]) at indicated time (h)			
	Prominent		Complete	
	24	48	24	48
Caspofungin				
RPMI 1640	8	8	16	16
AM3	4	4	4	8
Fluconazole				
RPMI 1640		1		

a common reason for discontinuation of CAPD (21). The typical etiologic organisms are gram-positive cocci (*Staphylococcus epidermidis* and *S. aureus*) and certain gram-negative bacteria such as *Escherichia coli* and *Klebsiella* and *Enterobacter* spp. Fungal peritonitis is rare, representing 2 to 7% of CAPD-related peritonitis, and the majority of cases are due to *Candida* spp. (5). *Trichosporon* spp. have rarely been described as causes of peritonitis (2, 3, 5, 6, 9, 12–14, 23–25). The clinical features of fungal peritonitis, including fever, abdominal pain, and cloudy fluid, are nonspecific and do not help to differentiate fungal from bacterial peritonitis. In some cases, as in our case, there may be a predominance of eosinophils in the ascitic fluid. *Trichosporon* spp. may have phylogenetic and biochemical similarities to *Cryptococcus*, such as growth at 37°C, urease production, and utilization of various carbohydrates. However, *Trichosporon* spp. generally have a different colonial morphology and produce hyphae. Colonies of *Cryptococcus* spp. are usually mucoid, with large, encapsulated yeast cells and no hyphae or pseudohyphae (16). False-positive cryptococcal antigen results have been observed in peritoneal fluid, as well as in serum (25), although this test is not recommended for diagnosis.

Trichosporon spp. are ubiquitous in nature and are a normal component of skin flora (19). The nomenclature for this genus has undergone taxonomic revision, and the old *Trichosporon beigelii* (also called *T. cutaneum*) classification is now divided into several species. Six of them are pathogenic to humans and occupy different niches on the human body (13). *Trichosporon* spp. are the etiologic agents of white piedra, a rare hair infection commonly seen in tropical climates and characterized by hard white-to-tan nodules that adhere to the hair shafts of the scalp, beard, eyebrows, eyelashes, and genital hair. *T. inkin* causes genital white piedra and has been reported rarely in the United States (10). However, the prevalence of *T. inkin* may be higher than suspected and may be endemic in certain areas such as Texas (4).

Trichosporon spp. have been implicated as a cause of disseminated infections, including endophthalmitis, bloodstream infections, prosthetic valve endocarditis (19), brain abscess, hepatitis (25), and peritonitis (2, 3, 5, 6, 9, 12–14, 23–25), especially in immunosuppressed patients (6, 15). *T. inkin* specifically has caused endocarditis (18), vascular access infection (11), pneumonia (20), lung abscess (1), and peritonitis associated with peritoneal dialysis (9, 13). Only two cases of *T. inkin* peritonitis have been reported in the literature, but other cases may have been reported using the older taxonomic name of *T. beigelii* (13).

Agents that have been used to treat patients with CAPD-associated peritonitis caused by *Trichosporon* spp. include i.v. and intraperitoneal amphotericin B, intraperitoneal flucytosine, intraperitoneal miconazole, oral ketoconazole, and oral fluconazole (1, 6). Some patients have responded to treatment with antifungal therapy alone (7); however, most cases also require catheter removal to achieve a cure of the infection (5).

To our knowledge, we have described the first case of *T. inkin* peritonitis treated with caspofungin. Despite high in vitro MICs of caspofungin for our *T. inkin* isolate, the patient improved clinically with this treatment. No therapeutic MIC ranges have been established for caspofungin with *Trichosporon* spp., as this fungus has generally exhibited in vitro resistance to caspofungin. Other published reports have demonstrated that echinocandins lack both in vitro and in vivo activity with *Trichosporon* spp. (8, 18, 24). Although plasma caspofungin levels were not measured in our patient, mean peak and trough plasma concentrations for caspofungin at the steady state have been reported to be approximately 10 and 2 μg/ml, respectively, in healthy volunteers (22). Antifungal susceptibility testing of our patient's isolate showed lower MICs when caspofungin was tested on AM3 than when it was tested on RPMI 1640; however, susceptibility testing methods have not yet been standardized for caspofungin. It is possible that caspofungin had some activity with this patient's *T. inkin* isolate if the MIC results of the use of AM3 were accurate. Removal of the Tenckhoff catheter may also have contributed to this patient's successful outcome. In this case, it remains unclear whether caspofungin had some in vivo activity with *T. inkin* that did not correlate with in vitro MICs or whether catheter exchange alone was sufficient to eradicate infection. The azoles, and in particular the newer extended-spectrum azole agents, ultimately may prove more effective in the treatment of *Trichosporon* infections (18). Further studies are warranted.

REFERENCES

1. **Ahlmen, J., L. Edebo, C. Eriksson, L. Carlsson, and A. K. Torgersen.** 1989. Fluconazole therapy for fungal peritonitis in continuous ambulatory peritoneal dialysis (CAPD): a case report. Perit. Dial. Int. **9:**79–80.
2. **Anuradha, S., A. Chatterjee, J. Bajaj, N. P. Singh, S. K. Agarwal, and R. Kaur.** 2000. *Trichosporon beigelii* peritonitis in a HIV-positive patient on continuous ambulatory peritoneal dialysis. J. Assoc. Physicians India **48:** 1022–1024.
3. **Carr, M. E., A. A. O'Brien, D. Moore, and J. A. Keogh.** 1987. *Trichosporon cutaneum* C. A. P. D. peritonitis. Postgrad. Med. J. **63:**1008.
4. **Chaumentin, G., A. Boibieux, M. A. Piens, C. Douchet, P. Buttard, J. L. Bertrand, and D. Peyramond.** 1996. *Trichosporon inkin* endocarditis: short-term evolution and clinical report. Clin. Infect. Dis. **23:**396–397.
5. **Cheng, I. K., G. X. Fang, T. M. Chan, P. C. Chan, and M. K. Chan.** 1989. Fungal peritonitis complicating peritoneal dialysis: report of 27 cases and review of treatment. Q. J. Med. **71:**407–416.
6. **De Saedeleer, B., J. Sennesael, P. Van der Niepen, and D. Verbeelen.** 1989. Intraperitoneal fluconazole therapy for *Trichosporon cutaneum* peritonitis in continuous ambulatory peritoneal dialysis. Nephrol. Dial. Transplant. **9:**1658–1659.
7. **Espinel-Ingroff, A.** 1998. Comparison of in vitro activities of the new triazole SCH56592 and the echinocandins MK-0991 (L-743,872) and LY303366 against opportunistic filamentous and dimorphic fungi and yeasts. J. Clin. Microbiol. **36:**2950–2956.
8. **Goodman, D., E. Pamer, A. Jakubowski, C. Morris, and K. Sepkowitz.** 2002. Breakthrough trichosporonosis in a bone marrow transplant recipient receiving caspofungin acetate. Clin. Infect. Dis. **35:**E35–E36.
9. **Herbrecht, R., H. Koenig, I. Walter, K. L. Liu, and E. Gueho.** 1982. Trichosporon infections: clinical manifestations and treatment. J. Mycol. Med. **3:**129–136.
10. **Kalter, D. C., J. A. Tschen, P. L. Cernoch, M. E. McBride, J. Sperber, S.**

Downloaded from http://jcm.asm.org/ on December 4, 2020 by guest

Bruce, and J. E. Wolf, Jr. 1986. Genital white piedra: epidemiology, microbiology, and therapy. J. Am. Acad. Dermatol. **14:**982–993.
11. **Kenney, R. T., K. J. Kwon-Chung, F. G. Witebsky, D. A. Melnick, H. L. Malech, and J. I. Gallin.** 1990. Invasive infection with *Sarcinosporon inkin* in a patient with chronic granulomatous disease. Am. J. Clin. Pathol. **94:**344–350.
12. **Lopes, J. O., S. H. Alves, J. P. Benevenga, A. C. Rosa, and V. C. Gomez.** 1994. *Trichosporon beigelii* peritonitis associated with continuous ambulatory peritoneal dialysis. Rev. Inst. Med. Trop. Sao Paulo **36:**121–123.
13. **Lopes, J. O., S. H. Alves, C. Klock, L. T. Oliveira, and N. R. Dal Forno.** 1997. *Trichosporon inkin* peritonitis during continuous ambulatory peritoneal dialysis with bibliography review. Mycopathologia **139:**15–18.
14. **Melez, K. A., J. Cherry, C. Sanchez, R. B. Ettinger, and T. J. Walsh.** 1995. Successful outpatient treatment of *Trichosporon beigelii* peritonitis with oral fluconazole. Pediatr. Infect. Dis. J. **14:**1110–1113.
15. **Moretti-Branchini, M. L., K. Fukushima, A. Z. Schreiber, K. Nishimura, P. M. Papaiordanou, P. Trabasso, R. Tanaka, and M. Miyaji.** 2001. *Trichosporon* species infection in bone marrow transplanted patients. Diagn. Microbiol. Infect. Dis. **39:**161–164.
16. **Murray, P. R., E. J. Baron, M. A. Pfaller, F. C. Tenover, and R. H. Yolken (ed.).** 1999. Manual of clinical microbiology, 7th ed., p. 1039–1073. ASM Press, Washington, D.C.
17. **National Committee for Clinical Laboratory Standards.** 1997. Reference method for broth dilution susceptibility testing of yeast. Approved standard M27-A. National Committee for Clinical Laboratory Standards, Wayne, Pa.
18. **Paphitou, N. I., L. Ostrozky-Zeichner, V. L. Paetznick, J. R. Rodriguez, E. Chen, and J. H. Rex.** 2002. In vitro antifungal susceptibilities of *Trichosporon* species. Antimicrob. Agents Chemother. **46:**1144–1146.
19. **Parsonnet, J.** 1989. *Trichosporon beigelii* peritonitis. South. Med. J. **82:**1062–1063.
20. **Piwoz, J. A., G. J. Stadtmauer, E. J. Bottone, I. Weitzman, E. Shlasko, and C. Cummingham-Rundles.** 2000. *Trichosporon inkin* lung abscesses presenting as a penetrating chest wall mass. Pediatr. Infect. Dis. J. **19:**1025–1027.
21. **Steinberg, S. M., S. J. Cutler, J. K. Novak, et al.** 1985. Report of the National CAPD Registry of the National Institutes of Health: characteristics of participants and selected outcome measures for the period January 1, 1981 through August 31, 1984, p. 224–232. *In* A. S. Lindblad, J. W. Novak, and Karl D. Nolph (ed.), National CAPD Registry for the National Institute of Arthritis, Diabetes and Digestive and Kidney Diseases. U.S. Public Health Services, Washington, D.C.
22. **Stone, J. A., S. D. Holland, P. J. Wickersham, et al.** 2002. Single- and multiple-dose pharmacokinetics of caspofungin in healthy men. Antimicrob. Agents Chemother. **46:**739–745.
23. **Ujhelyi, M. R., R. H. Raasch, C. M. van der Horst, and W. D. Mattern.** 1990. Treatment of peritonitis due to *Curvularia* and *Trichosporon* with amphotericin B. Rev. Infect. Dis. **12:**621–627.
24. **Uzun, O., S. Kocagoz, Y. Cetinkaya, S. Arikan, and S. Unal.** 1997. In vitro activity of a new echinocandin, LY303366, compared with those of amphotericin B and fluconazole against clinical yeast isolates. Antimicrob. Agents Chemother. **41:**1156–1157.
25. **Yuen, K. Y., W. H. Seto, K. S. Li, and R. Leung.** 1990. *Trichosporon beigelii* peritonitis in continuous ambulatory peritoneal dialysis. J. Infect. **20:**178–180.
26. **Zelenitsky, S., L. Barns, I. Findlay, M. Alfa, R. Ariano, A. Fine, and G. Harding.** 2000. Analysis of microbiological trends in peritoneal dialysis-related peritonitis from 1991 to 1998. Am. J. Kidney Dis. **36:**1009–1013.

Downloaded from http://jcm.asm.org/ on December 4, 2020 by guest