

Çetin Ozener  
Ibrahim Karayaylali  
Emin Yilmaz  
Fevzi Ersoy  
Taner Camsari  
Rezzan Ataman  
Semra Bozfakioglu  
Fehmi Akcicek  
Kenan Ates  
Turgay Arinsoy

Turkish Multicenter PD Study  
Group (TULIP), Turkey

## Three Cases of Uncommon Fungal Peritonitis in Patients Undergoing Peritoneal Dialysis

Fungal peritonitis is a serious complication of continuous ambulatory peritoneal dialysis (CAPD) and accounts for 2% to 10.2% of the total number of peritonitis episodes (1). It is usually caused by yeasts such as *Candida spp* and very rarely by filamentous fungi. During a 10-year period at our institute, four episodes of fungal peritonitis were due to filamentous fungi. One of them, previously published, was due to *Aspergillus niger* (2). The remaining three cases, caused by an atypical *Paecilomyces variotii*, *Fusarium solani*, and *Acremonium strictum*, are presented.

### PATIENTS AND METHODS

A total of 751 episodes of peritonitis were observed in 410 patients on CAPD between January 1991 and December 2000. The diagnosis of fungal peritonitis was based on clinical manifestations and cloudy dialysis effluent, with white cell count (WBC) of more than 100/mm<sup>3</sup>, and was confirmed by the isolation of the same fungus from more than one sample. Dialysis effluent was cultured on blood agar, MacConkey agar, and Sabouraud dextrose agar (SDA), and 5 mL was added to double-concentration thioglycollate broth. Incubation was for 7 days at 37°C. Filamentous fungi were identified by their macroscopic and microscopic features after subculture on potato dextrose agar. Patients diagnosed with fungal peritonitis were treated with increasing intravenous (IV) doses of amphotericin B (0.2 - 0.4 mg/kg/day) in combination with other antifungal agents.

### RESULTS

In the 751 episodes of peritonitis observed, fungi were identified as etiologic factors in 47 (6.3%). Four patients had a single episode caused by filamentous fungi (8.5% of total fungal peritonitis). Patient histories, clinical manifestations, and outcome of the three cases are analyzed below.

**Case 1:** A 65-year-old woman who had been on CAPD for 53 months was admitted to our unit with nausea, abdominal pain, and low-grade fever. During treatment with CAPD she had four episodes of bacterial peritonitis, the last one 10 months earlier, due to *Staphylococcus epidermidis* successfully treated with intraperitoneal (IP) administration of vancomycin. Clinical examination demonstrated abdominal rebound tenderness, cloudy dialysis effluent (450 WBC/mm<sup>3</sup>, with 85% neutrophils), and peripheral blood cell count of 13 800 WBC/mm<sup>3</sup>, with 75% neutrophils. Bac-

### REFERENCES

1. Pereira BJG, Levey AS. Hepatitis C virus infection in dialysis and renal transplantation. *Kidney Int* 1997; 51:981-99.
2. Seme K, Poljak M, Zuzek-Resek S, Avsic-Zupanc T. High prevalence of hepatitis C virus infection in hemodialysis patients from one dialysis unit in Slovenia. *Nephron* 1995; 71:99-100.
3. Chan TM, Lok ASF, Cheng IKP. Hepatitis C infection among dialysis patients: a comparison between patients on maintenance haemodialysis and continuous ambulatory peritoneal dialysis. *Nephrol Dial Transplant* 1991; 6:944-7.
4. Jadoul M, Cornu C, van Ypersele de Strihou C, and the UCL Collaborative Group. Universal precautions prevent hepatitis C virus transmission: a 54 month follow-up of the Belgian Multicenter Study. *Kidney Int* 1998; 53:1022-5.
5. Vladutiu DS, Cosa A, Neamtu A, State D, Braila M, Gherman M, et al. Infections with hepatitis B and C viruses in patients on maintenance dialysis in Romania and in former communist countries: yellow spots on a blank map? *J Viral Hepat* 2000; 7:313-19.
6. Cendoroglo Neto M, Draibe SA, Silva AE, Ferraz ML, Granato C, Pereira CA, et al. Incidence of and risk factors for hepatitis B virus and hepatitis C virus infection among haemodialysis and CAPD patients: evidence for environmental transmission. *Nephrol Dial Transplant* 1995; 10:240-6.
7. Akpolat T, Arik N, Günaydin M, Utas C, Dilek K, Çağlar S, et al. Prevalence of anti-HCV among haemodialysis patients in Turkey: a multicentre study. *Nephrol Dial Transplant* 1995; 10:479-80.
8. Akpolat T, Yavuz M, Utas C, Ozener Ç, Seyrek N, Yilmaz E, et al. CAPD: a control strategy to prevent spread of HCV infection in end-stage renal disease. *Perit Dial Int* 2001; 21:77-9.
9. Van Biesen W, Vanholder R, Lameire N. The role of peritoneal dialysis as the first-line renal replacement modality. *Perit Dial Int* 2000; 20:375-83.
10. Van Biesen W, Vanholder R, Lameire N. Impact of pretransplantation dialysis modality on patient outcome after renal transplantation: the role of peritoneal dialysis revisited. *Perit Dial Int* 1999; 19:103-6.

terial cultures of the dialysis effluent yielded no growth. Cultures from four consecutive specimens on SDA yielded a fast-growing filamentous fungus that could not be identified. The isolated mold was referred to several laboratories, but it remained unrecognized as a species of *Paecilomyces* until cultures were incubated at 37°C, whereupon they formed broad phialides and chains of conidia of various sizes. The isolate was deposited in the University of Alberta Microfungus Collection & Herbarium (UAMH) as UAMH 8517. Although it demonstrated microscopic features characteristic of *P. variotii* (3), it differed in having pale yellowish-white-to-buff rather than olive-brown colonies and in its faster growth rate at 37°C and 41°C.

The patient was treated with IV amphotericin B in a daily dose of 0.4 mg/kg/day for 3 weeks, followed by oral administration of ketoconazole (200 mg/day). The catheter was removed during the fifth day and the patient started hemodialysis. One month later, a new peritoneal catheter was inserted and she recommenced CAPD. The patient was reasonably well despite a significant loss of ultrafiltration. However, 3 months later she died with evidence of bowel rupture and septic shock during another episode of fungal peritonitis caused by *Candida albicans*.

**Case 2:** A 76-year-old female patient with renal failure due to antineutrophil cytoplasmic antibody-associated glomerulonephritis, treated with CAPD for 52 months, presented with peritonitis. During CAPD treatment, she had three episodes of bacterial peritonitis: two caused by *S. epidermidis* treated with IP administration of vancomycin, and one, 3 months earlier, due to *Enterococcus faecalis*, which was successfully treated with IP teicoplanin for 15 days. On admission, the patient had low-grade fever and abdominal pain associated with cloudy dialysis effluent (1500 WBC/mm<sup>3</sup>, with a predominance of neutrophils). While cultures of the dialysis effluent were negative for bacteria, three consecutive specimens on SDA yielded *Fusarium solani*. The peritoneal catheter was removed, a subclavian line was inserted for hemodialysis, and IV amphotericin B was given (0.2 mg/kg/day initially, increased to 0.3 mg/kg/day) for 4 weeks, followed by ketoconazole (200 mg/day orally) for 10 days. The peritonitis episode resolved, but the patient preferred to continue on regular hemodialysis.

**Case 3:** A 57-year-old woman with end-stage renal disease due to IgA nephropathy, on CAPD treatment for 48 months, was admitted to the hospital with progressively increasing abdominal pain, fever, and cloudy dialysis effluent. Two months earlier, the patient had an episode of peritonitis due to *Escherichia coli*, and she was treated successfully with IP administration of amikacin and ceftazidime for 21 days. On admission, microscopic examination of

dialysis effluent showed 400 cells/mm<sup>3</sup> with predominance of neutrophils, but dialysis effluent cultures were negative for bacteria. Cultures from four consecutive specimens of dialysis effluent on SDA yielded growth of an *Acremonium* species, which was also isolated from the tip of the catheter. Colonies were initially velvety white, but later became pale orange or salmon colored. Hyphae were septate and hyaline, and produced simple needle-shaped conidiophores bearing nonseptate cylindrical conidia arranged in a slimy mass. The isolate was referred to UAMH where it was deposited as UAMH 9972 and confirmed as *Acremonium strictum* (3).

The patient was treated with IV amphotericin B (0.3 mg/kg/day) for 10 days with concomitant IP 5-fluorocytosine (50 mg/2-L bag), followed by oral administration of fluconazole (100 mg/day) for 1 month. The peritoneal catheter was removed and the patient was transferred to hemodialysis. Since a dialysis unit had been organized in her hometown, the patient decided to continue treatment with hemodialysis.

#### DISCUSSION AND CONCLUSIONS

Of the 47 episodes of fungal peritonitis seen in our center during the past decade, four were caused by filamentous fungi. Our previously described patient with *Aspergillus niger* peritonitis was a unique case, having survived such a serious infection while on CAPD (2). The species identified in the present cases were *Paecilomyces variotii*, *Fusarium solani*, and *Acremonium strictum*. Despite the reported high morbidity and mortality among patients with fungal peritonitis, treatment of the infection was successful in these 3 patients, none of who had been on steroids or immunosuppressive therapy. One continued on CAPD despite reduced ultrafiltration and two were transferred to hemodialysis. One patient succumbed to a subsequent episode of *C. albicans* peritonitis.

Three different molds were involved in our cases of fungal peritonitis. At the time of these episodes, there were no other isolations of the same molds from patients in the hospital. *Paecilomyces* species are common saprobes in soil, peat, silage, and water, and until 1990 there had been no association with CAPD peritonitis. Korzets *et al.* reported that 13 of 14 published cases of *Paecilomyces* peritonitis were caused by *P. variotii* (4). *Paecilomyces variotii* is known to be relatively resistant to most sterilizing techniques (3).

*Fusarium* and *Acremonium* species are ubiquitous fungi found predominantly in soil, rhizospheres of plants, and foodstuffs. Both produce slimy conidia and are known to sporulate well in fluid environments. With the addition of the present case, *Fusarium* species have been reported in 12 CAPD patients with fungal peritonitis and, in 2 cases, the fungus has been

identified as *Fusarium solani* (5,6). Although *Acremonium* species are uncommonly associated with human disease, 2 reports now document *Acremonium kiliense* (2 cases) and *Acremonium strictum* (1 case) as etiologic factors of CAPD peritonitis (7,8).

In conclusion, peritonitis caused by filamentous fungi is a severe infection of the peritoneal cavity. Antifungal agents, especially amphotericin B, are effective but, as in other fungal peritonitis, institution of early treatment and removal of the peritoneal catheter lead to better patient outcome. Although rare, fungal peritonitis due to filamentous fungi must be considered during diagnostic procedures and examination of peritoneal effluent in CAPD patients.

Evangelia Bibashi<sup>1</sup>  
 Elisabeth Kokolina<sup>2</sup>  
 Lynne Sigler<sup>3</sup>  
 Danai Sofianou<sup>1</sup>  
 Dimitrios Tsakiris<sup>2</sup>  
 George Visvardis<sup>2</sup>  
 Menelaos Papadimitriou<sup>2</sup>  
 Dimitrios Memmos<sup>2</sup>

Department of Microbiology<sup>1</sup>  
 Department of Nephrology<sup>2</sup>  
 Hippokraton General Hospital  
 Thessaloniki, Greece  
 University of Alberta Microfungus Collection &  
 Herbarium<sup>3</sup>  
 Edmonton, Alberta, Canada

#### REFERENCES

- Keane WF, Vas SL. Peritonitis. In: Gokal R, Nolph KD, eds. *Textbook of Peritoneal Dialysis*. Dordrecht: Kluwer Academic; 1994: 473-501.
- Bibashi E, Papagianni A, Kelesidis A, Antoniadou R, Papadimitriou M. Peritonitis due to *Aspergillus niger* in a patient on continuous ambulatory peritoneal dialysis after kidney graft rejection. *Nephrol Dial Transplant* 1993; 8:185-7.
- Sigler L, Kennedy MT. *Aspergillus*, *Fusarium* and other opportunistic moniliaceous fungi. In: Murray PR, Baron EJ, Pfaller MA, Tenover FC, Tenover FC, eds. *Manual of Clinical Microbiology*. 7th ed. Washington: American Society for Microbiology; 1999: 1212-41.
- Korzets A, Weinberger M, Chagnac A, Goldschmied-Reouven A, Rinaldi MG, Sutton DA. Peritonitis due to *Thermoascus taitungiacus* (anamorph *Paecilomyces taitungiacus*). *J Clin Microbiol* 2001; 39:720-4.
- Flynn JT, Meislich D, Kaiser BA, Polinsky MS, Baluarte HJ. *Fusarium* peritonitis in a child on peritoneal dialysis: case report and review of the literature. *Perit Dial Int* 1996; 16:52-7.
- Nuno E, Cisneros JM, Regordan C, Montes R, Guerrero MA, Martin C. Peritonitis por *Fusarium solani*: una complicación infrecuente de la diálisis peritoneal. *Enferm Infecc Microbiol Clin* 1995; 13:196-7.
- Lopes JO, Alves SH, Rosa AC, Silva CB, Sarturi JC, Souza CAR. *Acremonium kiliense* peritonitis complicating continuous ambulatory peritoneal dialysis: report of two cases. *Mycopathologia* 1995; 131:83-5.
- Koc AN, Utas C, Oymac O, Sehmen E. Peritonitis due to *Acremonium strictum* in a patient on continuous ambulatory peritoneal dialysis. *Nephron* 1998; 79: 357-8.

## Hydrothorax Complicating Peritoneal Dialysis: Diagnostic Value of Glucose Concentration in Pleural Fluid Aspirate

Hydrothorax secondary to pleuroperitoneal communication as a complication of peritoneal dialysis (PD) was first described in 1967 (1). Pleuroperitoneal communication is not common and has been estimated to be present in only 1.6% to 10% of the PD population (2,3). Transudative pleural effusion due to various causes other than pleuroperitoneal communication, on the other hand, is a common clinical problem in PD patients (4). Therefore, an accurate method to diagnose pleuroperitoneal communication is important.

Traditionally, peritoneal scintigraphy has been the investigation of choice in the evaluation of suspected pleuroperitoneal communication (5-10). In clinical practice, however, therapeutic pleurocentesis is often required for symptomatic relief. Although the biochemical profile of the pleural fluid, especially a very high glucose concentration, does suggest pleuroperitoneal communication (9,11), the sensitivity and specificity of pleural fluid glucose concentration in the diagnosis of pleuroperitoneal communication have not been examined in detail, and the reference "normal" value is a matter of controversy (9,11-13). In this retrospective study, we examined the role of pleural fluid glucose level in the investigation of transudative pleural effusion among PD patients.

#### METHODS

From 1986 to 2001, 9 (1.0%) of 874 PD patients in our center had hydrothorax secondary to pleuroperitoneal communication. All patients were receiving continuous ambulatory peritoneal dialysis (CAPD) and presented with transudative pleural effusion. Pleural effusion was classified as transudate according to Light's criteria (14,15). In all 9 cases, the diagnosis of pleuroperitoneal communication was confirmed by scintigraphic study using technetium-99m-labeled macroaggregated albumin (99mTc MAA). They were designated the study group.