JIDC | THE JOURNAL OF INFECTION IN DEVELOPING COUNTRIES

Case Report

Successful treatment of peritonitis caused by Acremonium species without catheter removal: Case report and literature review

Zhen Zhuang[1], Yuehong Li[1], Xianglan Wu[1], Wei Wang[1], Mingxia Cao[1], Nan Xiao[2]

[1] Department of Nephrology, Beijing Tsinghua Changgung Hospital, School of Clinical Medicine, Tsinghua University, Beijing, China
[2] Laboratory Medicine Department, Beijing Tsinghua Changgung Hospital, School of Clinical Medicine, Tsinghua University, Beijing, China

Abstract

Introduction: It is a rare case of continuous ambulatory peritoneal dialysis-related peritonitis associated with Acremonium sp. infection.
Case presentation: Symptoms of *Acremonium* infection peritonitis are hidden and atypical, leucocytes in ascites are moderately elevated, and general bacterial culture difficulty obtains positive results. In this report, a patient with peritoneal dialysis-related peritonitis caused by *Acremonium* species was successfully treated without catheter removal in our hospital. The organism species was cultured from a catheter and PD effluent fluid. The patient's peritonitis did not relapse within 6 months.
Conclusions: Once a patient on peritoneal dialysis was infected with fungal peritonitis, the outcome was usually to remove the tube and stop peritoneal dialysis. In this case, our experience is that using a catheter-salvage therapy method, we can successfully cure PD-related peritonitis associated with *Acremonium* sp.

Key words: Fungal peritonitis; *Acremonium* species; peritoneal dialysis; catheter.

J Infect Dev Ctries 2023; 17(11):1631-1635. doi:10.3855/jidc.17679

(Received 22 November 2022 – Accepted 26 June 2023)

Introduction

During the COVID-19 pandemic, the advantage of peritoneal dialysis (PD) is evident due to home-based treatment. The number of patients with PD is increasing in China, and there were 126372 PD patients in 2021 [1]. Peritoneal dialysis (PD)-related peritonitis is recognized as a common complication of peritoneal dialysis. Fungal peritonitis (FP) is one of the most serious causes of catheter removal and death due to its low survival rate and difficult treatment, especially among patients with diabetes, hypoproteinemia, and other severe complications. Acremonium infection in PD patients is rare [2]. A case of continuous ambulatory peritoneal dialysis (CAPD)-related peritonitis caused by Acremonium species was successfully cured without catheter removal in our hospital.

Case presentation

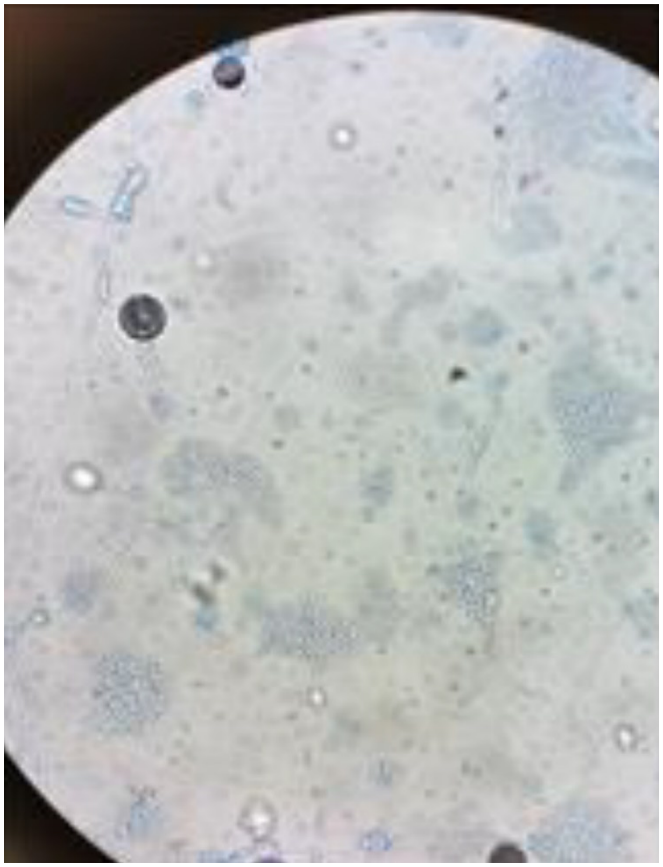
A 58-year-old man with end-stage renal disease secondary to diabetic nephropathy had been on CAPD therapy for eight months. He was admitted to Beijing Tsinghua Changgung Hospital with cloudy dialysate, combined with nausea and appetite. Physical examination revealed normal body temperature, blood pressure, and pulses and no periumbilical tenderness, defense, or rebound. No erythema or exudates were found around the PD catheter exit site, and moderate edema was found in the pretibial region. Laboratory examinations were as follows: leucocyte count was 1,983/mL in peritoneal dialysis effluent. Cultures were negative for blood and peritoneal dialysis fluid. Peritonitis was treated with intraperitoneal antibiotics (ceftazidime and vancomycin) and local mupirocin. On the fifth day of treatment, we found several white dot attachments in the inner wall of the external short tube (Figure 1). We replaced the external short tube immediately and sent the attachments for bacterial and fungal cultures. The cultures were negative in the first week. On the eighth day of treatment, leucocytes (177/mL) were detected in peritoneal dialysis effluent. The patient's symptoms were relieved, and antibiotics were discontinued. We applied 4000 mL peritoneal dialysis fluid to flush the abdominal cavity every day. On the tenth day of treatment, the patient exhibited abdominal fluid turbidity again, without fever and abdominal pain. In addition, higher leucocytes

(948/mL) were detected in the peritoneal dialysis fluid. Fungal colonies identified as *Acremonium species* were isolated in cultures inoculated with attachment in the inner wall of the external short tube. At the same time, we found 2 mm-diameter white cotton flocculation on the tip of the Tenckhoff catheter (Figure 2). Under strict disinfection, we cut off a 2 cm-long peritoneal dialysis tube near the titanium joint and replaced the titanium connector and the external short tube again. The same fungus grew from Tenckhoff catheter samples and peritoneal dialysate effluent. Cultured on Sabouraud's dextrose agar at 25 °C and incubated for 7 days revealed the growth of velvety down white colonies. Hyphae were septate and hyaline, 2 µm to 4 µm in diameter, with conidiophores bearing no septate, straight conidia arranged as heads on simple conidiophores, characteristic of *A. kiliense* (Figure 3). To determine the isolated fungi, deoxyribonucleic acid (DNA) from the isolate was extracted by Fungi/Yeast Genomic DNA Isolation Kit (Norgen Biotek Corp., Canada) according to the manufacturer's instructions. The PCR products were purified using GeneJET PCR Purification Kit (Thermo Fisher Scientific, Germany)) and underwent sequencing.

Figure 1. White dot attachment in the inner wall of the external short tube.

Figure 2. 2mm-diameter white cotton flocculation on the tip of 'Tenckhoff's catheter.

Figure 3. Characteristic of A kiliense.



The sequence was compared with those in GenBank by Blast program, and the fungus was identified as *Acremonium sp.*

This patient was diagnosed with PD-related peritonitis caused by *Acremonium species.* After we discussed the treatment with the patient and his family, they insisted on PD therapy and refused to switch to hemodialysis because his home was far from the hospital. Hemodialysis in the hospital was not convenient, particularly during the COVID-19 pandemic. Treatment involved repeated flushing of the abdominal cavity, applying intravenous fluconazole 0.2 g Qd for 2 weeks, and then switching to voriconazole for 1 month. Leucocytes in peritoneal dialysis effluent rapidly dropped to normal levels (72/mL) in 4 days. The patient's symptoms were relieved, and the peritonitis did not relapse within the next 6 months. Tenckhoff's catheter was not removed, and CAPD was continued.

Discussion

Acremonium species are widely distributed in nature and are commonly found in agricultural production and opportunistic infections in humans. Acremonium-like fungi are emerging as important opportunistic pathogens in cutaneous, subcutaneous, and serious invasive infections, especially in immunocompromised and debilitated individuals. Acremonium infections are usually resistant to antifungal therapy. Cardona *et al.* presented two hematologic malignancy patients with *Acremonium* fungemia who were refractory to amphotericin B and had a clinical response after changing to voriconazole [3]. Qazi *et al.* presented a 37-year-old female with lung abscess due to *Acremonium species* that responded to oral itraconazole [4]. Seong *et al.* reported *Acremonium* fungal keratitis caused by ocular trauma [5].

In the past two decades, a few cases of peritoneal dialysis-related peritonitis caused by Acremonium species have been reported [6,7], but no cases have been reported in China. J. O. Lopes reported two cases of peritonitis caused by *Acremonium kiliense* in patients receiving continuous ambulatory peritoneal dialysis treatment [6]. In this case, *Acremonium* infection was aggressive, peritonitis symptoms were atypical, leucocytes in ascites were moderately elevated, and general bacterial culture could not obtain positive results. Centrifuging the liquid and tube wall attachment may improve the positive culture result. In addition, if general bacteria cultured for 5 days showed negative results after empirical treatment and the number of white blood cells in the abdominal fluid could not be reduced to below 100/mL, attention should be given to the fungal infection. Old age, combined with diabetes, low resistance, and long-term use of antibiotics, are high-risk factors for opportunistic fungal infection. In addition, we recommend that fungal culture should be conducted simultaneously in the early stages of PD-related peritonitis and fungal petri dishes should be applied. It can improve the positive detection of fungal infection.

The source of *Acremonium* infection in the patient is difficult to ascertain. However, considering the manipulation involved in the procedure, environmental contamination is highly possible. The fungus inoculated in the catheter exit site suggests that the fungus gains entry through Tenckhoff's catheter. As the 2016

Table 1. Summary of cases of PD-related peritonitis caused by *Acremonium Spp*.

Country	Year	Age/ sex	Underlying condition(s)	Fungi	Medication	catheters	Patient outcome	Reference
USA	1982	68 yr/M	CAPD, ESRD	*Acremonium sp.and Klebsiella sp.*	Amphotericin B	removal	Died	Landay *et al.* [16]
Brazil	1995	8 yr/M	Chronic renal failure, RPGN	*A. kiliense*	Ketoconazole (100 mg/d during 1 month),	removal	Cured	Lopes *et al.* [6]
Turkey	1998	22 yr/M	ESRD	*A. strictum*	Amphotericin B i.p., i.v.	removal	Cured	Nedret Koc *et al.* [17]
Turkey	2007	7 mo	Down syndrome, AVSD and pulmonary hypertension, hyponatremia	*Acremonium* spp.	Fluconazole, amphotericin, B 3 weeks	removal	Died due to ventilator associated pneumonia and sepsis	Kendirli *et al.* (12)
Turkey	2008	47 yr/F	CAPD, DM, hypertensive nephropathy	*Acremonium* spp.	Oral fluconazole (100 mg/day)	removal	Cured	Sener *et al.* [7]
Kuwait	2011	75 yr/M	ESRD, DM and hypertension	*A. kiliense*	Oral voriconazole (200 mg twice daily) for 1 month	removal	Improved, died of Staphylococcus septicemia	Ziauddin Khan *et al.* [11]
Thailand	2020	46 yr/M	ESRD, DM	*Acremonium* spp.	Amphotericin B for 14 days, oral voriconazole for 7 days	salvage	Cured	Thana *et al.* [13]

International Society for Peritoneal Dialysis (ISPD) recommended [8], it is important to remove the catheter immediately and start temporary hemodialysis treatment when a fungal infection is identified by a microscope or culture. Some studies suggest that fungal peritonitis should pull the tube early, rather than immediately, with early use of antifungal drugs and abdominal flushing, until the abdominal fluid is clear, reducing the number of fungi and abdominal adhesion [9]. Other studies have shown that in abdominal flushing and antifungal treatment, PD catheters were not removed in 25% of patients. If patients have persistent clinical manifestations or positive blood cultures, tube extraction should be considered [10]. This patient did not pull out Tenckhoff's catheter. We repeatedly flushed the abdominal cavity, the number of fungi decreased, and abdominal adhesion was reduced. Second, the fungal implant in the inner wall of the external short tube and on the tip of Tenckhoff catheter provides the possibility of replacing and removing pathogen vectors. Finally, we selected sensitive antifungal drugs based on culture results and provided enough treatment time.

Optimal treatment of Acremonium species infection cases is limited. In addition, conflicting results have been obtained in different studies. Seven cases of Acremonium peritonitis were reported and are summarized in Table 1 [6,7,11-13,16,17]. The guidelines of the ISPD recommend that amphotericin B combined with cytosine be used for initial treatment, and follow-up treatment options be selected according to the type of fungus and the minimum antibacterial concentration. An amphotericin B protein binding rate > 90% and dispersion in abdominal fluid are low, and abdominal injection is not recommended because it stimulates the peritoneum with severe abdominal pain and abdominal adhesion [14].

Voriconazole or poseconazole may be better alternatives, particularly in patients with renal insufficiency. Chan *et al.* [15] studied 290 patients with CAPD and recommended that oral fluconazole was useful as initial therapy, followed by catheter removal if peritonitis failed to improve. The cure rate with fluconazole therapy alone without catheter removal was 9.5%, which increased to 66.7% when combined with catheter removal. Oral fluconazole can be safely used as an initial therapy in CAPD patients with fungal peritonitis or in combination with cytosine. The main therapy for fungal peritonitis is immediately removing the PD catheter and using antifungal agents. In this case, the patient was prescribed intravenous fluconazole for 2 weeks, voriconazole was replaced orally for one month, and Tenckhoff's catheter was not removed. Peritonitis did not occur in 6 months. We used a catheter-salvage therapy method to successfully cure PD-related peritonitis associated with *Acremonium sp.*

Conclusions

Acremonium species increase morbidity and mortality in immunosuppressed patients, such as peritoneal dialysis patients. Acremonium infection should be considered with atypical clinical presentation of peritoneal dialysis infection. Even though it is difficult to identify *Acremonium sp.* in microbial culture. In this case, we discarded the catheter with fungal adhesion, flushed the abdominal cavity repeatedly, and applied a sensitive antifungal drug (fluconazole intravenously and then oral voriconazole). It is a rare case of PD peritonitis associated with *Acremonium sp.* without catheter removal.

Acknowledgements

We thank the staff at Laboratory Medicine Department of Beijing Tsinghua Changgung Hospital for their valuable contributions to this study. We are grateful to Man Zhang for providing the samples and patient information.

Ethics approval and consent to participate

Because retrospective case studies have no identifiable patient information or privacy, ethical approval was waived by the Ethics Committee of Beijing Tsinghua Changgung Hospital. The patient's written informed consent has been obtained. All methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication

Written informed consent was obtained from the patient's parent/guardian for publication of this Case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Funding

This work was funded by the Incubation Program Project of Beijing Municipal Administration of Hospitals of China, under Grant [PG2019033]. The funders had no role in the study design, data collection and analysis, manuscript preparation, or decision to publish.

Authors' contributions

For this study, YHL and ZZ conceived and designed the experiments. XLW, WW, MXC and NX collected the clinical

samples, including the patients' information, performed the experiments, and analyzed the data. ZZ wrote the article. YHL, revised and edited the manuscript. All authors read and approved the final manuscript.

References

1. Zhang L, Wang J, Yang CW, Tang SC, Kashihara N, Kim YS, Togtokh A, Saad S, Ye F, Khan M, Zaidi D, Osman MA, Lunney M, Okpechi IG, Jha V, Harris DCH, Levin A, Tonelli M, Johnson DW, Bello AK, Zhao MH, ISN North and East Asia Regional Board (2021) International society of nephrology global kidney health atlas: structures, organization and services for the management of kidney failure in North and East Asia. Kidney Int Suppl 11: e77–e85. doi: 10.1016/j.kisu.2021.01.011.
2. Yao L, Wang H, Wan Z, Li R, Yu J (2019) The high diversity and variable susceptibility of clinically relevant acremonium-like species in China. Mycopathologia 184: 759–773. doi: 10.1007/s11046-019-00399-8.
3. Rodríguez ZC, Ramos MG (2014) Acremonium species associated fungemia: a novel pathogen in the immunosuppressed patient. Boletin de la Asociacion Medica de Puerto Rico 106: 29–31.
4. Qazi MS, Bowalekar SS, Wanjare VS, Shankar A (2015) An unusual case of lung abscess caused by Acremonium species treated with itraconazole. Indian J Med Microbiol 33: 307–310. doi: 10.4103/0255-0857.154893.
5. Kim SJ, Cho YW, Seo SW, Kim SJ, Yoo JM (2014) Clinical experiences in fungal keratitis caused by Acremonium. Clin Ophthalmol 8: 283–287. doi: 10.2147/OPTH.S54255.
6. Lopes JO, Alves SH, Rosa AC, Silva CB, Sarturi JC, Souza CA (1995) Acremonium kiliense peritonitis complicating continuous ambulatory peritoneal dialysis: report of two cases. Mycopathologia 131: 83–85. doi: 10.1007/BF01102883.
7. Sener AG, Yucesoy M, Senturkun S, Afsar I, Yurtsever SG, Turk M (2008) A case of *Acremonium strictum* peritonitis. Med Mycol 46: 495–497. doi: 10.1080/13693780701851729.
8. Li PK, Szeto CC, Piraino B, de Arteaga J, Fan S, Figueiredo AE, Fish DN, Goffin E, Kim YL, Salzer W, Struijk DG, Teitelbaum I, Johnson DW (2016) ISPD peritonitis recommendations: 2016 update on prevention and treatment. Perit Dial Int 36: 481–508. doi: 10.3747/pdi.2016.00078.
9. Sethna CB, Bryant K, Munshi R, Warady BA, Richardson T, Lawlor J, Newland JG, Neu A, SCOPE Investigators (2016) Risk factors for and outcomes of catheter-associated peritonitis in children: the SCOPE collaborative. Clin J Am Soc Nephrol 11: 1590–1596. doi: 10.2215/CJN.02540316.
10. Eisenberg ES, Leviton I, Soeiro R (1986) Fungal peritonitis in patients receiving peritoneal dialysis: experience with 11 patients and review of the literature. Rev Infect Dis 8: 309–321. doi: 10.1093/clinids/8.3.309.
11. Khan Z, Al-Obaid K, Ahmad S, Ghani AA, Joseph L, Chandy R (2011) Acremonium kiliense: reappraisal of its clinical significance. J Clin Microbiol 49: 2342–2347. doi: 10.1128/JCM.02278-10.
12. Kendirli T, Ciftçi E, Ekim M, Galip N, Düzenli F, Ozçakar ZB, Tapisiz A, Uçar T, Tutar E, Güriz H, Atalay S (2008) *Acremonium spp.* peritonitis in an infant. Mycoses 51: 455–457. doi: 10.1111/j.1439-0507.2008.01496.x.
13. Thongsricome T, Kanjanabuch T, Maeboonruen N, Pavatung P, Katavetin P, Eiam-Ong S (2020) Promising effect of in-situ lyticase enzyme therapy on peritoneal dialysis catheter obstruction from Acremonium fungal biofilm: A case report. Med Mycol Case Rep 30: 26–28. doi: 10.1016/j.mmcr.2020.09.006.
14. Regazzi M, Billaud EM, Lefeuvre S, Stronati M (2012) Pharmacokinetics of antifungal agents in neonates and young infants. Curr Med Chem 19: 4621–4632. doi: 10.2174/092986712803306402.
15. Chan TM, Chan CY, Cheng SW, Lo WK, Lo CY, Cheng IK (1994) Treatment of fungal peritonitis complicating continuous ambulatory peritoneal dialysis with oral fluconazole: a series of 21 patients. Nephrol Dial Transplant 9: 539–542. doi: 10.1093/ndt/9.5.539
16. Landay ME, Greenwald JH, Stemer AA, Ashbach DL (1982) Cephalosporium (acremonium) in dialysis-connected peritonitis. J Indiana State Med Assoc 75: 391.
17. Koç AN, Utaş C, Oymak O, Sehmen E (1998) Peritonitis due to *Acremonium strictum* in a patient on continuous ambulatory peritoneal dialysis. Nephron 79: 357–358. doi: 10.1159/000045067

Corresponding author

Yuehong Li, MD
Department of Nephrology,
Beijing Tsinghua Changgung Hospital,
Medical Center, Tsinghua University,
No. 168, Li Tang Rd, 102218,
Beijing, China.
Email: liyuehong0616@163.com
Tel: +86-13552733500

Conflict of interests: No conflict of interests is declared.