Case Report

DOI: 10.3947/ic.2011.43.3.275
Infect Chemother 2011;43(3):275-278
pISSN 2093-2340 eISSN 2092-6448

Infection & Chemotherapy

*Achromobacter xylosoxidans*에 의한 복막 투석 관련 복막염: 증례 보고와 포괄적 문헌 검토

오탁근[1] · 백지현[1] · 정수진[1] · 채윤태[1] · 구남수[1] · 진범식[1] · 한상훈[1] · 김창오[1] · 송영구[1,2] · 이호영[1] · 김준명[1,2] · 최준용[1,2]
연세대학교 의과대학 내과학교실[1], 에이즈 연구소[2]

Continuous Ambulatory Peritoneal Dialysis-Associated Peritonitis Caused by *Achromobacter xylosoxidans*: A Case Report and Comprehensive Literature Review

Achromobacter xylosoxidans is an uncommon cause of peritonitis in patients on maintenance continuous ambulatory peritoneal dialysis (CAPD). CAPD peritonitis caused by *Achromobacter xylosoxidans* carries high mortality and recurrence rates because of its virulence and resistance to most antimicrobial agents. We experienced a case of CAPD peritonitis caused by *Achromobacter xylosoxidans* in a patient with hypertension, diabetes mellitus, and end stage renal disease. The patient was treated with intravenous imipenem/cilastatin, and the CAPD catheter was removed. However, the patient died by aspiration pneumonia on the 34th day of hospitalization.

Key Words: *Achromobacter xylosoxidans*, Continuous ambulatory peritoneal dialysis, Peritonitis

Tak Geun Oh[1], Ji Hyeon Baek[1], Su Jin Jeong[1], Yoon Tae Chae[1], Nam Su Ku[1], Bum Sik Chin[1], Sang Hoon Han[1], Chang Oh Kim[1], Young Goo Song[1,2], Ho Yong Lee[1], June Myung Kim[1,2], and Jun Yong Choi[1,2]

Departments of [1]Internal Medicine, and [2]AIDS Research Institute, Yonsei University College of Medicine, Seoul, Korea

Introduction

Since the introduction of continuous ambulatory peritoneal dialysis (CAPD) by Popovish in 1976, peritoneal dialysis has been an important treatment for end stage renal disease (ESRD) [1]. Although its frequency in CAPD patients has been decreasing, peritonitis is still a major cause of morbidity and mortality in patients [1].

Achromobacter xylosoxidans is a gram-negative bacillus. The nomenclature originated from bacteria that produce alkaline (*Achromobacter*) and acid components from xylose using oxidation (xylosoxidans) [2]. The three species *Achromobacter faecalis*, *Achromobacter piechaudii*, and *Achromobacter xylosoxidans* exhibit these biochemical characteristics [3]. Among these, only *Achromobacter xylosoxidans* has been identified as a causative agent of CAPD peritonitis. This species is a rare pathogen of peritonitis. CAPD peritonitis caused by *Achromobacter xylosoxidans* has been treated by antibiotics with anti-pseudomonal effects after catheter removal [1-5]. However, it has high morbidity

Submitted: February 14, 2011
Revised: April 12, 2011
Accepted: April 13, 2011
Correspondence to Jun Yong Choi, M.D., Ph.D.
Department of Internal Medicine, Yonsei University College of Medicine, 250 Seongsan-ro, Seodaemun-gu, Seoul 120-752, Korea
Tel: +82-2-2228-1974, Fax: +82-2-393-6884
E-mail: seran@yuhs.ac

and recurrence rate because of its virulence and antimicrobial resistance [4].

Identification of *Achromobacter xylosoxidans* in peritoneal dialysate was first reported in 1980 [5], and since then there have been nine reported cases of CAPD peritonitis caused by *Achromobacter xylosoxidans* [1-8]. However, there is limited knowledge about the clinical characteristics, prognosis, or proper treatments of this fatal disease. We recently experienced one case of peritonitis by *Achromobacter xylosoxidans* and hereby report the case along with a comprehensive review of reported cases. To the best of our knowledge, this is the first comprehensive report of CAPD peritonitis caused by *Achromobacter xylosoxidans* in Korea.

Case report

A 74-year-old female with an 18-year history of diabetes, 13 years of high blood pressure, four years of ESRD and regular CAPD treatment, and a five-month history of recurrent peritonitis was diagnosed with peritonitis with turbid peritoneal dialysate for two weeks before presentation. Vancomycin and amikacin were empirically injected via peritoneal dialysate for seven days, but the leukocyte count of the peritoneal dialysate increased. *Achromobacter xylosoxidans* was identified in the peritoneal dialysate following cultivation examination. The strain was sensitive to ceftazidime, imipenem, meropenem, levofloxacin, and piperacillin, which led the patient's antibiotics to be changed to imipenem/cilastatin and piperacillin/tazobactam via peritoneal dialysate for another seven days. However, the patient showed mental changes and was transferred to our hospital via the emergency room.

At the time of arrival, she was diagnosed with peritonitis and septic shock and was moved to the intensive care unit. Her examination results showed a total leukocyte count in the peripheral blood of 21,330/μL (neutrophil 93.4%, lymphocyte 2.8%, monocyte 3.0%, eosinophil 0.2%, basophil 0.3%), and a platelet count of 289,000/μL. The leukocyte count of the peritoneal dialysate was 650/μL (82% polymorphonuclear cells, 18% mononuclear cells). At the day of arrival, ceftazidime and cefazolin were injected via peritoneal dialysate, and imipenem/cilastatin and vancomycin were empirically injected through a vein. On the third day after arrival, the leukocyte count in the peritoneal dialysate decreased to 310/μL (94% polymorphonuclear cells, 6% mononuclear cells), and the patient's vital signs were stabilized. *Pseudomonas aeruginosa,* which was sensitive to imipenem, meropenem and piperacillin, was identified in the cultivation examination of the peritoneal dialysate performed on the first hospital day; imipenem/cilastatin and vancomycin were maintained. On the fourth day after arrival, the patient had a fever and experienced mental changes, and the peritoneal dialysate became turbid again. Bowel perforation was excluded by simple abdomen and chest x-ray imaging. Laboratory tests were performed, showing a leukocyte count of 1,320/μL in the peritoneal dialysate (95% polymorphonuclear cells, 5% mononuclear cells). Another cultivation examination of the peritoneal dialysate identified *Achromobacter xylosoxidans*, which had the same sensitivity to antibiotics as the previous pathogen.

Since the peritonitis was not improved, the CAPD catheter was removed on the fifth day after admission. On the cultivation examination of the catheter, *Achromobacter xylosoxidans* and *Pseudomonas aeruginosa* were identified. According to antibiotics sensitivity, intravenous imipenem/cilastatin was maintained and vancomycin was empirically used every fourth day. CAPD was changed to hemodialysis three to four times a week. On the 25th hospital day, aspiration pneumonia and cellulitis on the right arm occurred. Even after antibiotic treatment and ventilator care, the aspiration pneumonia worsened, and the patient died on the 34th day of hospitalization.

Discussion

CAPD peritonitis is caused mainly by aerobic gram-positive cocci (*Staphylococcus epidermidis, Staphylococcus aureus*) or gram-negative bacilli (*Escherichia coli, Pseudomonas aeruginosa*), although anaerobes, fungi and mycobacteria have been identified in rare cases [1]. Up to 30% of cultivation examinations cannot identify a causative organism [1]. Generally, bacterial CAPD peritonitis is treated by an antimicrobial injection into the abdominal cavity and eliminated by intravenous antimicrobial treatments. However, peritonitis caused by gram-negative bacilli such as *Pseudomonas aeruginosa* requires CAPD catheter removal [3].

Achromobacter xylosoxidans was first reported by Yabuucho in 1971, identified from the suppurative exudates of seven patients with chronic otitis media [2]. *Achromobacter xylosoxidans* can be isolated from many clinical samples [1], but its frequency is rare, and this case is the first report of CAPD peritonitis caused by *Achromobacter xylosoxidans* in Korea. This species is an aerobic bacterium and a gram-negative bacillus, showing positive oxidase and catalase results [1]. This species is an organism of normal flora that can be identified from the alimentary canal or the skin

of normal human bodies, and can be identified in underwater environments as well [3]. As a pathogen, this species is more frequently identified in patients with immune deficiencies such as HIV (human immunodeficiency virus) infection or neutropenia. ESRD patients are another immune-deficient group, and the peritoneal dialysate itself offers a suitable aquatic environment for this strain [2]. The species has been reported to cause meningitis, eye infections, endocarditis, otitis media, respiratory infections, osteomyelitis and bacteremia, in addition to peritoneal dialysate infection. The treatment and prognosis are not clear due to the

Table 1. Reported Cases of CAPD Peritonitis by *Achromobacter xylosoxidans*

Patient No.	Sex/Age (year)	Underlying disease / associated conditions	In vitro susceptibility test	Co-infected pathogens	Treatment	Outcome	Catheter removal	Reported year [Reference]
1	M/53	DM	Susceptible to ampicillin, carbenicillin, colistin, TMP-SMX Resistant to gentamicin, kanamycin, tobramycin, amikacin/tetracycline	*Staphylococcus epidermidis*	carbenicillin IV	cured	No	1980 [2]
2	M/40	Severe multiple trauma, acute anuric renal failure	Susceptible to moxalactam	*Stenotrophomonas maltophilia*	moxalactam IV	died	No	1984 [6]
3	F/34	Glomerulonephropathy	Susceptible to TMP-SMX, amikacin, gentamicin, tobramycin, netilmicin, carbenicillin Resistant to ampicillin, cefamandole, cefoxitin, cephalothin, tetracycline, chloramphenicol	none	tobramycin, cephalothin IV TMP-SMX PO	cured	No	1986 [7]
4	M/45	Glomerulonephropathy	NA	none	vancomycin IP, gentamicin IP, ciprofloxacin PO, piperacillin IV	cured	Yes	1995 [3]
5	F/52	DM	Susceptible to ofloxacin Resistant to amikacin,aztreonam, cefazolin, cefotaxime, cefoxitin, ceftazidime, ceftriaxone, cefuroxime, ciprofloxacin, gentamicin, imipenem, piperacillin, tobramycin, TMP-SMX	none	vancomycin IP ceftazidime IV ofloxacin PO	cured	Yes	1998 [1]
6	F/46	IgA nephropathy	Resistant to ampicillin, cephalothin, ceftriaxone, gentamicin, amikacin, ciprofloxacin, TMP-SMX	none	1st (cefazolin P+ tobramycin IP) 2nd (ceftazidime IP+ amikacin IP) 3rd (piperacilliin/ azobactam IV)	cured	Yes	2001 [8]
7	F/35	IgA nephropathy, s/p kidney transplantation	Susceptible to piperacillin, ticarcillin, ceftriaxone, ceftazidime, tTMP-SMX Resistant to gentamicin, amikacin	none	1st (cefazolin P+ tobramycin IP) 2nd (ceftazidime IP+ amikacin IP) 3rd (piperacilliin/ tazobactam IV)	cured	Yes	2001 [8]
8	M/16	Idiopathic Fanconi syndrome	Susceptible to ciprofloxacin, imipenem Resistant to ceftazidime, TMP-SMX	none	1st (vancomycin IP+ ceftazidime IP+ ciprofloxacinPO) 2nd (ceftazidime IP+Amikacin IP+ trimethoprim/ sulfamethoxazole PO 3rd (imipenem IP+ ciprofloxacin PO)	cured	Yes	2004 [5]
9	F/72	DM, HTN	Susceptible to imipenem, piperacillin/tazobactam Resistant to cefotaxime, gentamicin, tobramycin	none	1st (ciprofloxacin PO+cefazolin IP+ceftazidime IP) 2nd (imipenem IV->IP) 3rd (ciprofloxacin PO)	cured	No	2007 [4]
10	F/76	DM, HTN	Susceptible to ceftazidime, cefoperazone/sulbactam, imipenem, meropenem, piperacillin Resistant to amikacin, ampicillin, cefepime, cefotaxime, gentamicin, levofloxacin	*Pseudomonas aeruginosa*	imipenem/cilastatin IV vancomycin IV ceftazidime+ vancomycin IP	died	Yes	2009 [11]

CAPD, continuous ambulatory peritoneal dialysis; IV, Intraveneous; IP, Intraperitoneal; PO, per os; DM, Diabetes mellitus; HTN, Hypertension; NA, Not available;TMP-SMX, Trimethoprim/ Sulfamethoxazole; s/p, status/post.

Table 2. Clinical Characteristics of 10 Reported Cases of CAPD Peritonitis by *Achromobacter xylosoxidans*

Characteristics	Value[a]
Mean age, years	46.9
Male sex	4 (40%)
Underlying disease/associated condition	
Diabetes Mellitus	4 (40%)
Hypertension	2 (20%)
Ig A nephropathy	2 (20%)
Surgical history of kidney transplantation	1 (10%)
Glomerulonephropahty	2 (20%)
Acute anuric renal failure	1 (10%)
Idiopathic Fanconi syndrome	1 (10%)
Co-infection	3 (30%)
Catheter removal	6 (60%)
Mortality	2 (20%)

[a]Values are expressed as number of cases (%) unless otherwise indicated.

rarity of cases [2].

There have been ten reported cases of CAPD peritonitis by *Achromobacter xylosoxidans*, including the one presented in this paper. We summarized the clinical characteristics of those cases in Table 1 and 2. Patient ages ranged from 16 to 76 years (mean age: 46.9), and the sex ratio was 4:6 (male:female). The underlying diseases included four cases of diabetes mellitus (DM), two cases of hypertension and Ig A nephropathy, one case of acute renal failure, and one case of idiopathic Fanconi syndrome. Co-infected pathogens were isolated in three patients, two of whom died. The first reported case of CAPD peritonitis caused by *Achromobacter xylosoxidans* was reported by Ingra and Siegman in 1980. *Achromobacter xylosoxidans* and *Staphylococcus epidermidis* were simultaneously identified with the cultivation examination of peritoneal dialysate, and the patient was completely cured with the use of parenteral carbenicillin [5]. However, in another report in which there were co-infections with *Stenotrophomonas maltophilia*, treatment failed [6]. Identification of only *Achromobacter xylosoxidans* was found in seven cases. One of seven cases was reported in 1986 by Morrison and Boyce. They initially used tobramycin and cephalothin, but the antimicrobials had no effect. The patient was cured with trimethoprim-sulfamethoxazole [2]. The rest of them resulted in treatment failure [7].

Achromobacter xylosoxidans is a rare cause of CAPD peritonitis with a high treatment failure rate. Because of its virulence and antimicrobial resistance, many experts recommend early catheter removal if patient condition does not improve [3]. Unfortunately, we cannot establish a standard antibiotic regimen or antimicrobial resistance pattern because there are only a few reported cases. We report one case of CAPD peritonitis caused by *Achromobacter xylosoxidans*, with a literature review. Further studies are necessary to identify the clinical characteristics, prognosis, and proper treatment of this disease.

References

1. El-Shahawy MA, Kim D, Gadallah MF. Peritoneal dialysis-associated peritonitis caused by *Alcaligenes xylosoxidans*. Am J Nephrol 1998;18:452-5.
2. Igra-Siegman Y, Chmel H, Cobbs C. Clinical and laboratory characteristics of *Achromobacter xylosoxidans* infection. J Clin Microbiol 1980;11:141-5.
3. Haqqie SS, Roth M, Bailie GR. Unsuccessful treatment of CAPD peritonitis caused by *Alcaligenes xylosoxidans* subsp. denitrificans. Ren Fail 1995;17:611-4.
4. Ledger SG, Cordy P. Successful treatment of Alcaligenes xylosoxidans in automated peritoneal dialysis-related peritonitis. Perit Dial Int 2007;27:596-8.
5. Melgosa M, Espinazo O, Alonso A, García Perea A, Navarro M. Dialysis-associated *Alcaligenes xylosoxidans* peritonitis: a pediatric case. Perit Dial Int 2004;24:72-5.
6. Reverdy ME, Freney J, Fleurette J, Coulet M, Surgot M, Marmet D, Ploton C. Nosocomial colonization and infection by *Achromobacter xylosoxidans*. J Clin Microbiol 1984;19:140-3.
7. Morrison AJ Jr, Boyce K 4th. Peritonitis caused by *Alcaligenes denitrificans* subsp. xylosoxydans: case report and review of the literature. J Clin Microbiol 1986;24:879-81.
8. Tang S, Cheng CC, Tse KC, Li FK, Choy BY, Chan TM, Lai KN. CAPD-associated peritonitis caused by *Alcaligenes xylosoxidans* sp. xylosoxidans. Am J Nephrol 2001;21:502-6.