□ CASE REPORT □

Morganella morganii Peritonitis Associated with Continuous Ambulatory Peritoneal Dialysis (CAPD) after Colonoscopy

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Abstract

A 79-year-old man on continuous ambulatory peritoneal dialysis (CAPD) developed abdominal pain and cloudy peritoneal fluid two days after colonoscopy that revealed multiple diverticula. The white blood cell count was 9,000 cells/ μ L, C-reactive protein level was 6.86 mg/dL, and the white blood cell count of the peritoneal fluid was 7,800 cells/ μ L, suggesting acute peritonitis. Empiric therapy consisting of cefazolin and ceftazidime slowly improved the patient's symptoms. The initial microbiological examination of the peritoneal fluid demonstrated *Morganella morganii*. He was changed from CAPD to hemodialysis. It is important to consider *M. morganii* peritonitis in patients with colonic diverticula.

Key words: acute peritonitis, continuous ambulatory peritoneal dialysis, *Morganella morganii*, colonoscopy, colonic diverticulum

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Introduction

Morganella morganii is a Gram-negative rod commonly found as normal flora in the intestinal tracts of humans, mammals, and reptiles or as environmental bacteria. Initially, *M. morganii* had been classified in the *Proteus* genus, and had been called *Proteus morganii*. In 1978, it was reclassified into the *Morganella* genus (1). A cluster of *M. morganii* infections occurred at a general tertiary hospital in 2006 (2), consisting of 61% wound infections and 39% urinary tract infections. *M. morganii* has been reported as the cause of urinary tract infections (3), arthritis (4), pericarditis (5), pyomyositis (6), sepsis (7), chorioamnionitis (8), ecthyma gangrenosum-like eruptions (9), meningitis (10), renal abscesses (11), and gas gangrene (12) in neonates or elderly immunocompromised patients or those with other serious underlying diseases.

M. morganii infections generally respond well to appropriate antimicrobial chemotherapy. However, its natural resistance to many β -lactam antimicrobial agents may lead to delays in proper treatment (13). We herein report a case of

peritonitis due to *M. morganii* related to CAPD after colonoscopy with a review of the pertinent literature.

Case Report

A 79-year-old Japanese man was admitted to the Division of Nephrology and Rheumatology at Aichi Medical University Hospital for a fever, abdominal pain, and cloudy peritoneal fluid. Thirty years prior to admission, he was diagnosed with hypertension. One year before admission, CAPD was initiated for end-stage kidney disease. His regular peritoneal dialysis routine consisted of four exchanges of 1.5 L bags of 1.5% glucose solution. His daily urine output ranged from 400 to 1,200 mL. Two days before admission, he underwent colonoscopy for an evaluation of diarrhea. Multiple diverticula were observed in the colon, and a diagnosis of diverticulosis was made (Figure). No pathologic organisms were detected. On the day of colonoscopy, he stopped peritoneal dialysis to empty and rest the peritoneal cavity. Several hours after the resumption of peritoneal dialysis, he developed abdominal pain with cloudy peritoneal fluid.

On admission, he was afebrile at 36.5°C and complained

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Figure. Colonoscopic examination. Multiple diverticula were observed.

of abdominal pain. His pulse was 53 beats/min and regular, and blood pressure was 178/62 mmHg. His body weight was 58.0 kg with 1.5 L of peritoneal fluid. A physical examination revealed a normal mental status, a clean surgical scar in the neck, and diffuse abdominal tenderness with rebound tenderness. There was no erythema or other signs of infection at the catheter exit site. Laboratory studies included a white blood cell (WBC) count of 9,000 cells/ μ L, hemoglobin 9.4 g/dL, hematocrit 27.9%, platelet count 16.5×10^4 cells/ μ L, albumin 2.5 g/dL, blood urea nitrogen 61.9 mg/dL, and creatinine 6.60 mg/dL. The Na concentration was 137 mEq/L, K 2.4 mEq/L, Cl 101 mEq/L, AST 29 U/L, and ALT 24 U/L. The lactate dehydrogenase concentration was 302 IU/L, CK 337 IU/L, and CRP 6.86 mg/dL. The WBC count of the peritoneal fluid was 7,800 cells/ μ L (71.5% neutrophils, 8.5% lymphocytes, and 20% macrophages). A blood culture examination revealed no bacteremia.

On hospital day 5, after cefazolin (1.0 g/day) and ceftazidime (1.0 g/day) were started empirically, the WBC count of the peritoneal fluid became 51 cells/ μ L, and the CRP level was 2.0 mg/dL. The initial peritoneal fluid bacterial culture grew out *Morganella morganii* resistant to cefotiam (CTM), sulfamethoxazole (SBTPC), and fosfomycin (FOM), and sensitive to third-generation cephalosporins such as cefepime pivoxil (CFPN-PI), ceftazidime (CAZ), and cefpodoxime proxetil (CPDX-PR). We continued CAZ for 16 days and discontinued cefazolin. The patient's clinical condition and laboratory data improved gradually. He was changed from CAPD to hemodialysis due to the risk of bacterial biofilm formation and recurrence of peritonitis due to multiple diverticulosis.

Discussion

Morganella morganii is a Gram-negative rod that is part of the normal flora of the intestinal tract in humans and other animals. Characteristics of this organism include indole production, ornithine decarboxylase, urease, phenyl-

alanine deaminase, and growth in KCN (1). In addition, *Morganella* species are capable of producing β -lactamases (13). Initially, *M. morganii* was mainly identified as a cause of urinary tract infections (3), and it has subsequently been isolated in patients with pneumonia, wound infections, skin and soft tissue infections (2), nonclostridial gas gangrene (12), meningitis (10), and sepsis (7). Falagas et al. reported 24 patients infected with *M. morganii* over a four-year period in a general tertiary hospital in Greece with 650 beds (2). They noted that skin and soft tissue infections were the most common type of infections due to *M. morganii*. Only one patient had peritonitis secondary to appendicitis, and 58% of the patients in that series had polymicrobial infections. They also commented that 70% and 96% of isolated *M. morganii* were resistant to ceftriaxone, and amoxicillin/clavulanic acid, respectively. Chen et al. performed whole genome sequencing and identification of *M. morganii* (14). Out of 82,861 samples they examined, *M. morganii* was isolated in 1,219 samples (1.47%) during a six-year period (2006-2011) in Taiwan. They found novel characteristics of *M. morganii* through an analysis of pathogenicity-related genes. In the present patient, *M. morganii* was resistant to cefazolin but sensitive to ceftazidime.

Regarding peritonitis due to *M. morganii*, Isobe et al. first reported a patient with spontaneous bacterial emphysema and peritonitis in 1994 (15). The second case was part of a case series by Falagas et al. (2). The first case of CAPD-related peritonitis caused by *M. morganii* appeared in Turkey in 2010 (16). The second case occurred in Taiwan (17) and the third case was in Austria (18). The present case is the fourth such case so far reported in the literature (Table).

We changed the patient from CAPD to hemodialysis due to the risk of bacterial biofilm formation by *M. morganii* and multiple diverticulosis. *M. morganii* produces urease, which generates ammonia from urea, and is associated with crystalline bacterial biofilm formation on urinary catheters (19). It is able to survive in acidic conditions, and the urease it produces is activated in low pH environments. In addition, the present patient had multiple diverticula, which

Table. Cases of Peritonitis Associated with *Morganella morganii*.

Ref	Age	Sex	Condition	Complication	Treatment	Duration of antibiotic therapy	Outcome
15	55	M	spontaneous empyema	liver cirrhosis	gentamycin, third-generation cephalosporin	14 days	cure
2	33	M	appendicitis, peptic ulcer disease	nephrolithiasis	ceftriaxone, metronidazole, amoxicillin	12 days	cure
16	55	F	CAPD	<i>Providencia rettgeri</i>	changed to HD cefoperazone, vancomycin changed to imipenem, amikacin	14 days	cure re-start CAPD
17	62	F	CAPD	two months after <i>Prevotella species</i> peritonitis	cefmetazone was changed to ceftazidime	10 days	cure
18	53	M	CAPD	IgA nephropathy	conversion to HD	13 days	cure
			diverticulosis		ceftazidime, vancomycin	after 4 months	re-start CAPD
This case	68	M	CAPD	nephrosclerosis	cefazolin, ceftazidime	16 days	cure
			diverticulosis post-colonoscopy				conversion to HD

is a weak portion of bacterial penetration, and can induce recurrent peritonitis. Imai et al. have reported barium enema examination-induced diverticulitis and perforated peritonitis (20). In Europe and the United States, 30-40% of individuals over 60 years of age have diverticulosis, and the incidence increases with age. In Japan, the incidence of diverticulosis is approximately 20% in individuals over 60 years of age, compared to 5% in individuals younger than 40 years of age. This is the first reported case of peritonitis caused by *M. morganii* after colonoscopy. If patients have multiple diverticula, colonoscopy may induce bacterial peritonitis, sometimes *M. morganii*-related peritonitis. In the present case, we did not use antibiotics before colonoscopy. When we have to perform colonoscopy in patients on CAPD, cefditoren pivoxil, cefixime, levofloxacin, or norfloxacin is recommended as prophylactic antibiotics. Extreme care should therefore be taken during colonoscopy, especially in patients on CAPD.

The authors state that they have no Conflict of Interest (COI).

References

- O'Hara CM, Brenner FW, Miller JM. Classification, identification, and clinical significance of *Proteus*, *Providencia*, and *Morganella*. Clin Microbiol Rev 13: 534-546, 2000.
- Falagas ME, Kavvadia PK, Mantadakis E, et al. *Morganella morganii* infections in a general tertiary hospital. Infection 34: 315-321, 2006.
- Jones BD, Mobley HL. Genetic and biochemical diversity of ureases of *Proteus*, *Providencia*, and *Morganella* species isolated from urinary tract infection. Infect Immun 55: 2198-2203, 1987.
- Schonwetter RS1, Orson FM. Chronic *Morganella morganii* arthritis in an elderly patient. J Clin Microbiol 26: 1414-1415, 1988.
- Sica S, Di Mario A, Salutari P, et al. *Morganella morganii* pericarditis after resolvent splenectomy for immune pancytopenia following allogeneic bone marrow transplantation for acute lymphoblastic leukemia. Clin Infect Dis 21: 1052-1053, 1995.
- Arranz-Caso JA, Cuadrado-Gomez LM, Romanik-Cabrera J, García-Tena J. Pyomyositis caused by *Morganella morganii* in a patient with AIDS. Clin Infect Dis 22: 372-373, 1996.
- Salen PN, Eppes S. *Morganella morganii*: a newly reported, rare cause of neonatal sepsis. Acad Emerg Med 4: 711-714, 1997.
- Johnson JR, Feingold M. Case of chorioamnionitis in an immunocompetent woman caused by *Morganella morganii*. J Matern Fetal Med 7: 13-14, 1998.
- Del Pozo J, García-Silva J, Almagro M, Martínez W, Nicolas R, Fonseca E. Ecthyma gangrenosum-like eruption associated with *Morganella morganii* infection. Br J Dermatol 139: 520-521, 1998.
- Samonis G, Anatoliotaki M, Apostolou H, Souglakos J, Georgoulas V. Fatal septicemia and meningitis due to *Morganella morganii* in a patient with Hodgkin's disease. Scand J Infect Dis 33: 553-555, 2001.
- Osana S, Nakata H, Ishida K, et al. Renal abscess with *Morganella morganii* complicating leukemoid reaction. Intern Med 47: 51-55, 2008.
- Ghosh S, Bal AM, Malik I, Collier A. Fatal *Morganella morganii* bacteraemia in a diabetic patient with gas gangrene. J Med Microbiol 58 (Pt 7): 965-967, 2009.
- Pitout JD, Sanders CC, Sanders WE Jr. Antimicrobial resistance with focus on β -lactam resistance in gram-negative bacilli. Am J Med 103: 51-59, 1997.

14. Chen YT, Peng HL, Shia WC, et al. Whole-genome sequencing and identification of *Morganella morganii* KT pathogenicity-related genes. BMC Genomics **13** (Suppl 7): S4, 2012.
15. Isobe H, Motomura K, Kotou K, Sakai H, Satoh M, Nawata H. Spontaneous bacterial emphyema and peritonitis caused by *Morganella morganii*. J Clin Gastroenterol **18**: 87-88, 1994.
16. Atalay H, Güney I, Solak Y, Almaz E. First case of CAPD-related peritonitis caused by *Morganella morganii*. Perit Dial Int **30**: 119-121, 2010.
17. Tsai MT, Yeh JT, Yang WC, Wu TH. CAPD-related peritonitis caused by *Morganella morganii*. Perit Dial Int **33**: 104-105, 2013.
18. Windpessl M, Prammer W, Asböck R, Wallner M. More on peritonitis by *Morganella morganii*. Perit Dial Int **33**: 467-468, 2013.
19. Stickler D, Morris N, Moreno MC, Sabbuba N. Studies on the formation of crystalline bacterial biofilms on urethral catheters. Eur J Clin Microbiol Infect Dis **17**: 649-652, 1998.
20. Imai H, Satoh K. Perforated diverticulitis after barium enema examination in a patient on CAPD. Nephrol Dial Transplant **12**: 2758-2760, 1997.