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Original Article

Peritoneal dialysis-related peritonitis from *Burkholderia pseudomallei* infection (Melioidosis) of northeast Thailand

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ABSTRACT

Objectives: Melioidosis is an uncommon cause of peritonitis in patients with end-stage renal disease who are receiving continuing peritoneal dialysis. This study aims to investigate the prevalence and outcome of peritoneal dialysis-related peritonitis due to *Burkholderia pseudomallei* infection.

Materials and Methods: A retrospective cohort study of melioidosis infection between 2018 and 2022, peritoneal dialysis-related peritonitis in cases with end-stage renal failure was collected. The patients' demographics, clinical characteristics, and treatments were described.

Results: Of the 194 cases diagnosed with peritoneal dialysis-related peritonitis, there were 7 patients (3.6%) with melioidosis peritonitis. The patients' mean age was 51.1 ± 9.44 years old, range of 40–65. Diabetes (5 cases, 71.4%) and hypertension (7 cases, 100%) were the most common co-morbidities. Six cases (85.7%) had fever, 5 (71.4%) had hazy dialysate, and everyone had abdominal pain as clinical signs. Associated septicemia was observed in 5 (71.4%) cases. As part of their antibiotic therapy, meropenem was given to 1 (14.3%) and ceftazidime to 6 (85.7%) cases. Six cases (85.7%) received intravenous antibiotics, whereas 1 (14.3%) case received both intravenous and intraperitoneal routes. The catheters were removed; then, hemodialysis sessions of 5 (71.4%) cases were initiated. Hemodialysis mode was switched permanently in 3 (42.9%) cases and temporarily in one case, thereafter, peritoneal dialysis was resumed. 3 (42.9%) cases died. No significant relations were found about risk factors between survivor and non-survivor group ($P < 0.05$).

Conclusion: Peritoneal dialysis-related peritonitis due to melioidosis is uncommon. However, it may be accompanied by catheter loss and can be lethal if untreated as systemic melioidosis.

Keywords: Melioidosis, Dialysis, Peritonitis

INTRODUCTION

Peritonitis is the most common and serious consequence of peritoneal dialysis. More than 15% of patients undergoing peritoneal dialysis die directly or as a result of peritoneal dialysis-related peritonitis.[1,2] The most common reason for transitioning to long-term hemodialysis is a single episode of severe peritonitis or multiple bouts of peritonitis, both of which typically result in a loss in peritoneal ultrafiltration capacity. Gram-positive cocci, such as *Staphylococcus epidermidis* and *Staphylococcus aureus*, are the most common cause of peritoneal dialysis-related peritonitis globally.[3,4] The variety of organisms associated with peritonitis varies by geography, as does the frequency of episodes with negative cultures. Because 20% of cultures are negative, it is recommended that appropriate laboratory samples be obtained before the introduction of antibiotics.[5,6] Cloudy effluent in peritoneal dialysis patients should be considered an indication of peritonitis, which should be confirmed by an effluent white blood cell (WBC) count of more than 100/mL, differential count, culture, and Gram staining. Even if the effluent is clear, patients with abdominal pain should always consider peritonitis because it affects only a tiny percentage of patients.[7]

The etiological agents responsible for peritonitis in tropical regions, such as Thailand, may differ from those in other parts of the world due to differences in climatic and microbiological circumstances. *Burkholderia pseudomallei*, a Gram-negative bacteria, is native to Southeast Asia and Northern Australia. It is known to cause melioidosis, which can be lethal in people.[8,9] Melioidosis is typically transmitted through percutaneous injection, inhalation, or ingestion, and it can cause localized or disseminated illnesses.[10] The bacterium is often found in soil and water, making it a major threat in tropical settings. Peritoneal dialysis-related

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peritonitis is hypothesized to have an unusual cause of melioidosis.[11,12] The coexistence of *B. pseudomallei* and peritoneal dialysis is a concerning situation, as infection with this organism might have disastrous effects on peritoneal dialysis patients. Furthermore, the bacterium's natural resistance to several antibiotics, as well as its ability to build biofilms, makes eradication difficult. As a result, peritoneal dialysis-related peritonitis caused by *B. pseudomallei* is a major concern in tropical countries where melioidosis is common. The purpose of this study was to investigate the prevalence and outcome of peritoneal dialysis-related peritonitis caused by *B. pseudomallei* infection.

MATERIALS AND METHODS

Study design

This study adopted a retrospective design, encompassing patients diagnosed with peritoneal dialysis-related peritonitis and subsequently admitted to Sakon Nakhon Hospital. Data were retrospectively extracted from medical records, with the requisite informed consent, spanning the period from January 2018 to December 2022. Demographic characteristics, including age, gender, primary cause of end-stage renal disease, and co-morbidities, were meticulously reviewed. Pertinent peritonitis information, such as incidence, prior peritonitis history, clinical signs and symptoms, leukocyte and polymorphonuclear cell counts in peritoneal effluent, antibiotic treatments, catheter removal, and overall outcomes, was systematically documented.

The diagnosis of peritoneal dialysis-related peritonitis adhered to the 2022 guidelines issued by the International Society for Peritoneal Dialysis (ISPD).[13] Peritoneal-related peritonitis was considered confirmed when at least two of the following three criteria were met: (1) clinical manifestations indicative of peritonitis, such as abdominal pain, turbid dialysate, and fever; (2) peritoneal effluent with a leukocyte count exceeding 100 cells per microliter and a leukocyte differential containing more than 50% of polymorphonuclear cells; and (3) a positive effluent culture. A positive culture for *B. pseudomallei* was mandatory to diagnose peritoneal dialysis-related peritonitis attributed to *B. pseudomallei* infection. Cases of peritoneal dialysis-related peritonitis were identified among patients receiving inpatient care. Subsequently, patients with peritoneal dialysis-related peritonitis linked to melioidosis were identified based on adherence to the ISPD diagnostic guidelines.

Quantitative variables were presented as means with corresponding standard deviations, whereas categorical variables were expressed as frequencies with percentages. To facilitate between-group comparisons, categorical variables were assessed using the Fisher's exact test. All data analyses were conducted utilizing Statistics Kingdom® (Australia, Version 2017), with significance defined as $P < 0.05$.

RESULTS

Of the 194 cases diagnosed peritoneal dialysis-related peritonitis, there were only 7 patients (3.6%), four females and three males infected due to *B. pseudomallei*. These patients ranged in age from 40 to 65. The mean age was 51.1, with a standard deviation of 9.44. 5 of the 7 cases (71.4%) had diabetes, 1 (14.3%) had hypertension, and 1 (14.3%) had renal stone disease as their primary disease. Hypertension (7 cases, 100%), diabetes (5 cases, 71.4%), cardiovascular disease (2 cases, 28.6%), gout (1 case, 14.3%), and neurovascular disease (1 case, 14.3%) were the prevalent concomitant conditions. Clinical presentations included abdominal pain in 7 (100%) cases, fever in 6 (85.7%) cases, and cloudy effluent in 5 (71.4%) cases. Septicemia was identified as being present in the 5 (71.4%) cases. WBC and neutrophil counts were both >100/L and 50%, respectively, in the peritoneal effluent of all seven cases. Prior peritonitis had occurred in 2 (28.6%) cases within a month before and antibiotics had been used. However, medication for prophylaxis was not given to these patients [Table 1].

The result of laboratory data is shown in Table 2.

The discovered microorganisms in bacterial culture included all *B. pseudomallei*. While the finding of the antibiotic susceptibility tests was sensitive to ceftazidime and carbapenems from all samples; however, one sample developed trimethoprim-sulfamethoxazole (TMP/SMX) resistance. Except for three cases, all hospitalized patients were given antibiotics for a period of 2 weeks. Ceftazidime was given to 6 (85.7%) cases and meropenem was given to 1 (14.3%) case. In 6 (85.7%) cases, the administrations of the antibiotics were done intravenously, whereas in 1 case used an early intraperitoneal route and then shifted intravenously later during the induction phase. Five (71.4%) cases switched to hemodialysis mode after the catheters were removed. The hemodialysis mode was changed permanently in 3 (42.8%) cases later. In 1 (14.3%) case, peritoneal dialysis was resumed after a brief period of hemodialysis. However, finally 3 (42.8%) patients died while receiving antibiotic treatments. For all alive patients, TMP/SMX was administered for 20 weeks during the eradication phase. After 6 months of follow-up period, there were no recurrent infections.

A comparison of risk factors in the survivor and non-survivor group is shown in Table 3. The result was no related factors impacting in survival of both patient groups significantly ($P > 0.05$).

DISCUSSION

The current study's participants all complained of stomach pain, with other symptoms such as fever and unclear effluent.

Table 1: Baseline characteristics and clinical presentations.

Characters	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Ages (years)	48	40	56	63	42	44	65
Gender							
Male				+	+		+
Female	+	+	+			+	
Primary disease							
Diabetes	+	+	+		+		+
Hypertension				+			
Stone						+	
Clinical presentation							
Abdominal pain	+	+	+	+	+	+	+
Turbid dialysate	+	+	+			+	+
Fever		+	+	+	+	+	+
Sepsis at presentation		+	+		+	+	+
Relapsed peritonitis			+				+
Comorbid disease							
Diabetes	+	+	+		+		+
Hypertension	+	+	+	+	+	+	+
Cardiovascular disease	+		+	+			
Neurovascular disease	+						
Gout				+			
Prior antibiotics use ≤1 month			+				+
Month of infection	September	October	July	October	August	July	June

Table 2: Laboratory data.

Lab list	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Hematocrit (%)	23	31	25	21	24	22	24
WBC count (/mm^3)	14,790	20,420	11,990	8,690	13,160	20,110	24,010
Platelet count (/mm^3)	318,000	157,000	229,000	177,000	824,000	480,000	6,000
Albumin (g/L)	2.2	3.1	2.1	2.1	1.7	2.2	1.0
Effluent WBC (/mm^3)	4,237	383	1,401	1,253	820	1,193	5,269
Effluent neutrophil (%)	87	89	91	47	74	92	91
Calcium (mmol/L)	8.5	8.5	9.3	8.9	9.5	9.4	7.7
Phosphorus (mmol/L)	7.9	2.7	3.2	6.4	1.6	5.6	4.1
Potassium (mmol/L)	4.3	4.2	3.1	4.7	5.7	3.6	4.0
Sodium (mmol/L)	138	128	141	133	129	135	142
Bicarbonate (mmol/L)	27	18	19	26	28	20	22
Blood glucose (mg/dL)	90	208	225	84	177	98	95

WBC: White blood cell

Diabetes (71.4%) was the most common primary condition, with hypertension being the most common comorbid disease in all cases. Adults with underlying medical conditions that increase risk were classified as high-risk categories, which was consistent with earlier studies; diabetes was the most common cause of these disorders, accounting for around 50% of instances.[14,15] The majority of cases appeared between June and October, reflecting the previously found link to the wet season.[16] The majority of situations required significant involvement. This highlighted the disease's seriousness from the start.[17] The treatment consisted of an inductive phase that included intravenous meropenem in one case and ceftazidime in six. Because the ISPD recommendations lack a unified therapy prescription, there were few therapeutic options available for melioidosis peritonitis. As long as there were no systemic sepsis signs, intraperitoneal antibiotic injection was the suggested treatment.[18] However, when there is an unavoidable delay in administering intraperitoneal antibiotics, the intravenous route must be used as a stopgap to ensure timely therapy.[19] The drug sensitivity pattern seen in this study was consistent with previous findings; nonetheless, there was little medication resistance discovered.[20] If intravenous antibiotics did not treat the peritonitis, the next logical step would be to remove the catheter as soon as

Table 3: Comparison of risk factors in survivor and non-survivor groups.

Relative factor	Survivor *n* (%)	Non-survivor *n* (%)	*P*-value*
Male gender	2 (28.6)	1 (14.3)	1.00
Age ≥60 years	1 (14.3)	1 (14.3)	1.00
Diabetes	2 (28.6)	3 (42.8)	0.43
Hypertension	4 (57.1)	3 (42.8)	1.00
Diabetes and hypertension	2 (28.6)	3 (42.8)	0.43
Cardiovascular disease	2 (28.6)	1 (14.3)	1.00
Sepsis at presentation	2 (28.6)	3 (42.8)	0.43
Relapsed peritonitis	0 (0)	2 (28.6)	0.14
Prior antibiotics use	0 (0)	2 (28.6)	0.14
Hematocrit <24%	3 (42.8)	0 (0)	0.14
Albumin <3 g/L	4 (57.1)	2 (28.6)	0.43
Effluent WBC ≥1,000/mm^3	3 (42.8)	2 (28.6)	1.00
Effluent neutrophil >75%	2 (28.6)	3 (42.8)	0.43
No catheter removal	0 (0)	2 (28.6)	0.14

*Statistical significance (P<0.05), WBC: White blood cell

feasible. Five patients' catheters were removed prematurely due to severe septicemia, and hemodialysis was performed in place of peritoneal dialysis. Despite the removal of catheters in two individuals, the outcomes were still unsuccessful, and the same was true for another who did not have the catheter removed. Following 2 weeks of induction, we administered oral co-trimoxazole for 20 weeks as eradication therapy. Other medications, such as doxycycline and amoxicillin-clavulanic acid, can be used instead during the eradication phase and as post-exposure prophylaxis.[21] According to the treatment summary, three patients died of septicemia and septic shock despite receiving adequate antibiotic treatment. Diabetes, chronic kidney illness, thalassemia, and immunocompromised states were all associated with higher mortality rates.[22] Unfortunately, the number of patients in this study limited the ability to determine the association between impact factors and infection survival. No statistical significance was determined between the survivor and non-survivor groups. Finally, among the patients who remained alive, one continued peritoneal dialysis, whereas three went to hemodialysis permanently.

The first attempt to evaluate the global burden of human melioidosis was made in 2016, with forecasts of 165,000 cases and 89,000 fatalities each year.[23] Melioidosis is found in all tropical locations, however, it is most common in Southeast Asia and Northern Australia.[24] In Northeast Thailand, a 40.0% case mortality rate and around 2,000 culture-confirmed melioidosis cases were reported per year.[25] Because melioidosis is a disease that must be recorded under Thai law, current official data appear to underestimate disease-related mortality dramatically. Furthermore, a serological study in Northeast Thailand found an age- related increase in seroprevalence, with more than 80% of individuals over the age of four testing positive.[26] When these data are expanded to include all melioidosis cases, the annual incidence is expected to be 10 cases per 100,000 individuals. The severity of this disease serves as a reminder to increase staff knowledge, keep a high level of suspicion, and improve microbiological methods. Early treatment with melioidosis can enhance outcomes. At the same time, further research is needed to create vaccinations, therapeutic procedures that reduce treatment time, and serological tests for diagnosis.

CONCLUSION

Melioidosis-related peritonitis linked with peritoneal dialysis is uncommon, however, it may be accompanied by catheter loss and could be lethal if untreated as systemic melioidosis. Early clinical diagnosis and the start of antibiotic therapy are essential for effective treatment.

Ethical approval

The present study has been approved by the Ethics Committee of Sakon Nakhon Hospital, approval Code: COE No.055/2566. All procedures performed in the present study were in accordance with the Helsinki Declaration.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The author confirms that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Teitelbaum I. Peritoneal dialysis. N Engl J Med 2021;385:1786-95.
2. Szeto CC, Li PK. Peritoneal dialysis-associated peritonitis. Clin J Am Soc Nephrol 2019;14:1100-5.
3. Mehrotra R, Devuyst O, Davies SJ, Johnson DW. The current state of peritoneal dialysis. J Am Soc Nephrol 2016;27:3238-52.
4. Sahlawi MA, Wilson G, Stallard B, Manera KE, Tong A, Pisoni RL, *et al*. Peritoneal dialysis-associated peritonitis outcomes reported in trials and observational

studies: A systematic review. Perit Dial Int 2020;40:132-40.
5. Bieber S, Mehrotra R. Peritoneal dialysis access associated infections. Adv Chronic Kidney Dis 2019;26:23-9.
6. Oki R, Tsuji S, Hamasaki Y, Komaru Y, Miyamoto Y, Matsuura R, *et al*. Time until treatment initiation is associated with catheter survival in peritoneal dialysis-related peritonitis. Sci Rep 2021;11:654-7.
7. Ong LM, Ching CC, Wee HC, Supramaniam P, Zainal H, Goh BL, *et al*. Risk of peritoneal dialysis-related peritonitis in a multi-racial Asian population. Perit Dial Int 2017;37:35-43.
8. Jagtap N, Shah H, Kancharla A, Tandan M, Pal P, Lakhtakia S, *et al*. Gastrointestinal manifestations of melioidosis: A single center experience. Indian J Gastroenterol 2017;36:141-4.
9. Teparrukkul P, Kongkasame W, Chitsaeng S, Wongsuwan G, Wuthiekanun V, Peacock SJ, *et al*. Gastrointestinal tract involvement in melioidosis. Trans R Soc Trop Med Hyg 2017;111:185-7.
10. Gassiep I, Armstrong M, Norton R. Human melioidosis. Clin Microbiol Rev 2020;33:e00006-19.
11. Chakravorty A, Heath CH. Melioidosis: An updated review. Aust J Gen Pract 2019;48:327-32.
12. Currie BJ. Melioidosis and *Burkholderia pseudomallei*: Progress in epidemiology, diagnosis, treatment and vaccination. Curr Opin Infect Dis 2022;35:517-23.
13. Li PK, Chow KM, Cho Y, Fan S, Figueiredo AE, Harris T, *et al*. ISPD peritonitis guideline recommendations: 2022 update on prevention and treatment. Perit Dial Int 2022;42:110-53.
14. Aulia Z, Wan Ali WA, Shahar MA. Encapsulating peritoneal sclerosis associated with *Burkholderia pseudomallei* peritonitis. Saudi J Kidney Dis Transpl 2018;29:1484-7.
15. Yin S, Tang M, Rao Z, Chen X, Zhang M, Liu L, *et al*. Risk factors and pathogen spectrum in continuous ambulatory peritoneal dialysis-associated peritonitis: A single center retrospective study. Med Sci Monit 2022;28:e937112.
16. Kanjanabuch T, Lumlertgul N, Pearson LJ, Chatsuwan T, Pongpirul K, Leelahavanichkul A, *et al*. Peritoneal dialysis-related peritonitis due to melioidosis: A potentially devastating condition. Perit Dial Int 2017;37:183-90.
17. Jabbar Z, Currie BJ. Melioidosis and the kidney. Nephrology (Carlton) 2013;18:169-75.
18. Dance D. Treatment and prophylaxis of melioidosis. Int J Antimicrob Agents 2014;43:310-8.
19. Sullivan RP, Marshall CS, Anstey NM, Ward L, Currie BJ. 2020 review and revision of the 2015 Darwin melioidosis treatment guideline; paradigm drift not shift. PLoS Negl Trop Dis 2020;14:e0008659.
20. Laws TR, Taylor AW, Russell P, Williamson D. The treatment of melioidosis: Is there a role for repurposed drugs? A proposal and review. Expert Rev Anti Infect Ther 2019;17:957-67.
21. Lim YM, Vadivelu J, Mariappan V, Venkatraman G, Vellasamy KM. Effective therapeutic options for melioidosis: Antibiotics versus phage therapy. Pathogens 2022;12:11-5.
22. Majoni SW, Hughes JT, Heron B, Currie BJ. Trimethoprim+sulfamethoxazole reduces rates of melioidosis in high-risk hemodialysis patients. Kidney Int Rep 2017;3:160-7.
23. Chalmers RM, Majoni SW, Ward L, Perry GJ, Jabbar Z, Currie BJ. Melioidosis and end-stage renal disease in tropical northern Australia. Kidney Int 2014;86:867-70.
24. Selvam K, Ganapathy T, Najib MA, Khalid MF, Abdullah NA, Harun A, *et al*. Burden and risk factors of melioidosis in Southeast Asia: A scoping review. Int J Environ Res Public Health 2022;19:15475.
25. Jatapai A, Gregory CJ, Thamthitiwat S, Tanwisaid K, Bhengsri S, Baggett HC, *et al*. Hospitalized bacteremic melioidosis in rural Thailand: 2009-2013. Am J Trop Med Hyg 2018;98:1585-91.
26. Bhengsri S, Baggett HC, Jorakate P, Kaewpan A, Prapasiri P, Naorat S, *et al*. Incidence of bacteremic melioidosis in eastern and northeastern Thailand. Am J Trop Med Hyg 2011;85:117-20.

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