Analysis of Causes and Nursing Experience of Refractory Peritoneal Dialysis-Associated Peritonitis: A Postprint

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Abstract

To explore the potential causes of peritoneal dialysis-related refractory peritonitis and the corresponding nursing measures after catheter removal, a retrospective analysis was conducted on the clinical diagnosis, treatment, and nursing process of two patients with refractory peritonitis in our department, summarizing the clinical characteristics of the disease and nursing experience. Both patients exhibited a thin body habitus and hypoalbuminemia, did not strictly adhere to operating procedures in daily practice, and failed to attach sufficient importance to peritoneal dialysis-related peritonitis, resulting in delayed medical consultation. Following admission, after 10–20 days of intraperitoneal and peripheral anti-infective therapy, peritoneal bacteriological examination showed no significant improvement; catheter removal was performed and the patients were switched to hemodialysis. Environmental factors, operational issues, intestinal causes, nutritional status, and awareness of and attention to peritonitis are contributing factors to the development of refractory peritonitis; self-management among peritoneal dialysis patients should be strengthened.

Full Text

Preamble

Title: Cause Analysis and Nursing Management of Peritoneal Dialysis-Associated Refractory Peritonitis
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Abstract

Objective: To investigate the underlying causes of peritoneal dialysis-associated refractory peritonitis and summarize appropriate nursing interventions following catheter removal.

Methods: We retrospectively analyzed the clinical treatment and nursing care of two patients with refractory peritonitis in our department, summarizing the clinical characteristics and nursing experiences.

Results: Both patients had slender body types with hypoalbuminemia and had not strictly followed operating procedures in their daily lives. Their lack of awareness regarding peritoneal dialysis-associated peritonitis led to delayed medical consultation. After admission, they received intraperitoneal and systemic anti-infective therapy for several days without significant improvement in bacteriological examination results. The peritoneal dialysis catheter was subsequently removed, and the patients were switched to hemodialysis.

Conclusion: Environmental factors, operational procedures, intestinal causes, nutritional status, and disease awareness are key contributors to refractory peritonitis. Nursing efforts should focus on strengthening self-management education for peritoneal dialysis patients to prevent this serious complication.

Keywords: refractory peritonitis; cause analysis; infection; hemodialysis; self-management

Introduction

Peritoneal dialysis is an established renal replacement therapy for end-stage renal disease. Compared with hemodialysis, it offers advantages including operational simplicity, minimal cardiovascular impact, and preservation of residual renal function, leading to widespread clinical adoption. However, peritoneal dialysis-associated peritonitis remains a major complication. According to the 2016 ISPD Peritonitis Diagnosis and Treatment Guidelines, refractory peritonitis is defined as persistent cloudy effluent or sustained effluent leukocyte count $>100 \times 10^6$/L despite appropriate antibiotic therapy for 5 days. This article reports the cause analysis and nursing experiences based on two cases of refractory peritonitis treated in our department.

1. Clinical Data

Case 1

A patient with a height of 165 cm and weight of 48 kg (BMI 17.6 kg/m^2) presented with a slender body type. In 2018, the patient developed anorexia and was found to have serum creatinine >900 mol/L with bilateral kidney atrophy on ultrasound, leading to a diagnosis of chronic renal failure (uremic stage). Peritoneal dialysis catheter placement was performed in August 2018, followed by regular peritoneal dialysis with an ultrafiltration volume of approximately 800 mL/day. In early December 2019, the patient's ultrafiltration volume decreased to 200–300 mL/day for about one week, accompanied by bilateral lower extremity edema, without seeking targeted diagnosis and treatment. The patient was admitted with abdominal pain, vomiting, and cloudy dialysate, diagnosed as "chronic renal failure (uremic stage), peritoneal dialysis-associated peritonitis."

On admission, blood pressure was 70/40 mmHg. Ascitic fluid cytology showed: white blood cell count (WBC) 38,400 × 10^6/L, red blood cell count (RBC) 1,000 × 10^6/L, and polymorphonuclear neutrophils (PMN) 85%, indicating septic shock. Empirical treatment with meropenem plus linezolid was initiated, along with fluid resuscitation. After 3 days, shock symptoms resolved. Ascitic fluid culture revealed *Escherichia coli* (non-drug-resistant), and antibiotics were de-escalated to piperacillin-tazobactam. The patient continued to have daily cloudy ascitic fluid with fever (temperature 38.5°C). On day 7, Hs-CRP was 180 mg/L, and ascitic fluid cytology showed WBC 2,400 × 10^6/L and RBC 1,000 × 10^6/L. On day 10, the patient developed fever again (39.0°C) with yellowish cloudy drainage fluid. Imipenem was administered for secondary anti-infective treatment, and the peritoneal cavity was irrigated daily with normal saline.

Ancillary tests showed albumin 24 g/L, and nutritional support was provided with intravenous human albumin and immunoglobulin therapy, plus probiotics to prevent antibiotic-associated intestinal flora imbalance. Due to persistent cloudy drainage and intermittent fever, the peritoneal dialysis catheter was removed on day 15. Internal medicine anti-infective therapy continued, but the patient remained intermittently febrile. Ultrasound examination revealed abdominal and pelvic effusions requiring surgical intervention. On day 20, laparoscopic drainage of abdominal abscess was performed. The patient's condition gradually improved, the drainage tube was removed, vascular access was established, and the patient was switched to hemodialysis.

Case 2

A patient with a height of 160 cm and weight of 45 kg (BMI 17.6 kg/m^2) also presented with a slender body type. In 2017, elevated serum creatinine was discovered incidentally (>900 mol/L). The patient had previously received traditional Chinese medicine and hormone therapy without regular follow-up. In December 2018, serum creatinine progressively increased to >1,000 mol/L,

confirming chronic renal failure (uremic stage). Peritoneal dialysis catheter placement was performed in January 2019, with regular peritoneal dialysis and an ultrafiltration volume of approximately 800 mL/day.

On December 5, 2019, the patient developed fever (38.5°C) without apparent cause and did not seek medical attention. Subsequently, the patient experienced fatigue, abdominal pain, diarrhea (loose stools), fever (maximum 39.5°C), chills, and cloudy dialysate. The patient was admitted with a diagnosis of "chronic renal failure (uremic stage), peritoneal dialysis-associated peritonitis" and received intraperitoneal cefazolin plus ceftriaxone for anti-infective treatment. On admission day 3, the patient still had abdominal discomfort. Ascitic fluid culture revealed *Staphylococcus aureus* infection. Due to severe peritonitis requiring prevention of bloodstream infection, peritoneal dialysis was suspended, and meropenem plus vancomycin was administered intravenously.

Laboratory tests showed albumin 22 g/L. Nutritional support was provided with intravenous human albumin. The patient's condition gradually improved, the drainage tube was removed, vascular access was established, and the patient was switched to hemodialysis.

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2. Nursing Care

2.1 Cause Analysis

Environmental and Operational Factors: Continuous ambulatory peritoneal dialysis (CAPD) accounts for approximately 80% of peritoneal dialysis patients. This dialysis modality involves frequent operations with high environmental requirements. The home environment comprises living areas, dialysate exchange areas, and dialysate storage areas. Patients must perform exchanges in a relatively independent area with daily cleaning and ultraviolet disinfection. When engaging in social activities such as work or travel, appropriate exchange locations must be identified for safe procedures; otherwise, peritoneal dialysis-associated peritonitis is highly likely to occur. Furthermore, dialysate exchange procedures must strictly follow protocols with aseptic technique. Special attention is required for the external short tube's dark blue area, pull-ring protection area, and the interior of the iodine solution mini-cap, which should not be touched. One patient occasionally performed exchanges in the bedroom and did not seek timely medical attention when cloudy effluent was observed. Therefore, standardized exchange environments and sterile technique are crucial for preventing peritonitis.

Intestinal Factors: Intestinal infections, constipation, and gastroenteritis can exacerbate peritonitis caused by intestinal microorganisms. Maintaining oral hygiene can effectively reduce peritonitis incidence. Intestinal infections may result from consuming inadequately heated food, requiring patient education about thorough food heating during preparation. One patient had a history

of gastric disease and constipation two days before infection. Therefore, preventing constipation can help prevent peritoneal dialysis-associated peritonitis. Patients can be taught to practice Tai Chi or Baduanjin, encouraged to exercise regularly, or use medications or colon dialysis under medical guidance to prevent constipation.

Nutritional Status: Studies have shown that hypoalbuminemia is an independent risk factor for peritonitis. For every 10 g/L decrease in serum albumin, the risk of peritoneal dialysis-associated peritonitis increases by 1.5 times. Both patients in this report had hypoalbuminemia. Patients should be educated about dietary nutrition, consumption of high-quality protein, and enhancement of autoimmunity. Peritoneal dialysis patients should undergo regular nutritional risk screening. According to the "Recommendations for Classification of Adult Body Mass Index in China," BMI categories are: underweight (BMI < 18.5 kg/m^2), normal (18.5–23.9 kg/m^2), overweight (24.0–27.9 kg/m^2), and obese (≥ 28.0 kg/m^2). Case 1 had albumin 24 g/L and BMI 17.6 kg/m^2; Case 2 had albumin 22 g/L and BMI 17.6 kg/m^2. Nutritional risk assessment and BMI measurement can guide individualized nutritional interventions. Personalized dietary guidance can improve quality of life and prevent peritoneal dialysis-associated peritonitis.

Awareness and Attention: Patients with lower education levels have relatively lower awareness of disease and health knowledge, understanding and cognitive levels, resulting in higher peritonitis risk. Awareness becomes more relaxed with longer dialysis duration. Therefore, regular patient education should be conducted using oral questioning, questionnaires, and scenario simulations to reinforce and consolidate peritoneal dialysis knowledge. When patients have persistent high fever and ultrasound shows abdominal abscess, timely abscess clearance and drainage should be performed. After catheter removal with drainage tube retention, nursing care should be intensified to prevent catheter-related infection. With the increasing number of peritoneal dialysis patients, healthcare providers should strengthen education through oral questioning, questionnaires, and scenario simulations, reinforcing knowledge about exchange environments, aseptic technique, exit-site care, intestinal management, and nutritional status to avoid complacency and prevent health hazards that increase patients' psychological and economic burden.

2.2 Nursing Measures After Drainage Tube Placement

Psychological Nursing: Both patients initially experienced anxiety, irritability, and unwillingness to communicate with others after catheter removal and drainage tube placement. In response, nursing staff patiently communicated with patients during daily rounds, inquiring about their feelings and answering questions. Patients gradually transitioned from initial anxiety to acceptance. Therefore, emphasizing psychological nursing, strengthening nurse-patient communication, enhancing trust, and providing encouragement are crucial for promoting active treatment cooperation and improving patient awareness and com-

pliance.

Dietary Nursing: To meet treatment needs and promote recovery, dietary intervention was implemented with reasonable nutritional guidance. Adequate caloric intake enables effective nitrogen utilization in low-protein diets. Based on patient conditions, nutritionists developed targeted meal plans. After these interventions, the two patients' albumin levels increased to 32 g/L and 30 g/L respectively before discharge.

Drainage Tube Nursing: After abdominal and pelvic drainage tube placement, the catheter should be properly secured and kept patent. Patients should be instructed to maintain a semi-reclining position and avoid compressing, kinking, or pulling the drainage tube during position changes. Drainage fluid characteristics, color, volume, and odor should be closely observed and recorded. To prevent infection, strict aseptic technique should be maintained, and drainage bags should be changed every 24 hours. Through meticulous nursing care, no catheter-related infection occurred before tube removal.

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3. Discussion

By reviewing the diagnosis and treatment process of these peritonitis cases and combining with the 2016 ISPD Peritonitis Diagnosis and Treatment Guidelines, our experience is as follows: For refractory peritonitis that persists with cloudy effluent or effluent leukocyte count $>100 \times 10^6$/L after 5 days of appropriate antibiotic therapy, timely catheter removal is essential to protect the peritoneum. If patients have persistent high fever and ultrasound demonstrates abdominal abscess, prompt abscess clearance and drainage should be performed. After catheter removal with drainage tube retention, nursing care should be strengthened to prevent catheter-related infection. As the number of peritoneal dialysis patients continues to increase, healthcare providers should enhance education efforts using oral questioning, questionnaires, and scenario simulations to reinforce knowledge about exchange environments, aseptic technique, exit-site care, intestinal management, and nutritional status, thereby preventing complacency that may lead to health hazards and increased psychological and economic burden for patients.

Conflict of Interest Statement: The authors declare no conflict of interest.

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Note: Figure translations are in progress. See original paper for figures.