Nursing Experience of Retraining Patients with Peritoneal Dialysis-Associated Peritonitis: A Single-Center Postprint

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Abstract

Objective To analyze the causes and characteristics of peritoneal dialysis-associated peritonitis in a hospital peritoneal dialysis center and to explore the timing, content, and implementation effectiveness of retraining. Methods Patients with end-stage renal disease undergoing peritoneal dialysis treatment at the Peritoneal Dialysis Center of The Third Hospital of Hebei Medical University who could be regularly followed up were selected. The incidence rate and characteristics of peritonitis in our center during 2019 were analyzed. Based on the principle of continuous quality improvement, the timing, content, and nursing process for retraining were proposed, and implementation effectiveness was observed and compared with the incidence rate and characteristics of peritonitis in peritoneal dialysis patients in 2020. Results Among 99 peritoneal dialysis patients in 2019, 22 patients experienced 27 episodes of peritonitis. The annual peritonitis incidence rate was 1/35.2 patient-months. Among them, 17 patients experienced first-time occurrence, with 11 (64.71%) cases occurring within 6 months after peritoneal dialysis catheterization. There were 12 culture-positive episodes, including 7 episodes of coagulase-negative staphylococcus and Staphylococcus aureus infection. The first retraining timing was set at the 3rd month after initiating peritoneal dialysis, with the main content being standardized procedures. After implementing retraining, among 101 peritoneal dialysis patients in our center in 2020, 10 patients experienced 11 episodes of peritonitis. The annual peritonitis incidence rate was 1/108.5 patient-months. Among 9 patients with first-time peritonitis, 2 (22.22%) cases occurred within 6 months after catheterization. There were 7 (63.64%) culture-positive episodes, including 3 episodes of Staphylococcus aureus infection and 4 episodes of Escherichia coli. Conclusion Implementing a retraining program can significantly reduce the incidence of peritoneal dialysis-associated peritonitis in hospital peritoneal dialysis centers.

Full Text

Nursing Experience of Retraining Patients with Peritoneal Dialysis-Related Peritonitis in a Single Center

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Abstract

Objective: To analyze the causes and characteristics of peritoneal dialysis (PD)-related peritonitis in our hospital's PD center, and to explore the optimal timing, content, and implementation effectiveness of patient retraining programs.

Methods: We selected patients undergoing peritoneal dialysis for end-stage renal disease at the PD center of The Third Hospital of Hebei Medical University who could be followed up regularly. By analyzing the incidence rate and characteristics of peritonitis in our center during the year prior to intervention, we identified key issues and, following continuous quality improvement (CQI) principles, designed a retraining protocol specifying timing, content, and nursing procedures. The effectiveness of this intervention was evaluated by comparing peritonitis incidence and characteristics with data from the year following implementation.

Results: Prior to CQI implementation, among PD patients, there were episodes of peritonitis. The annual peritonitis rate was per patient-month. Of these, patients experienced their first episode, with culture-positive episodes. Coagulase-negative staphylococcus and staphylococcus aureus accounted for % of cases, and % occurred within months after PD catheter insertion. Based on these findings, we scheduled the first retraining session at months after PD initiation, focusing on standardized operating procedures. Following implementation, among PD patients, episodes occurred in patients. The annual peritonitis rate decreased to per patient-month. Among patients experiencing peritonitis for the first time, % occurred within months post-catheterization, and % of episodes were culture-positive, including cases of staphylococcus aureus and cases of escherichia coli.

Conclusion: Implementing a structured retraining program significantly reduced the incidence of PD-related peritonitis in our center. Scheduling the first retraining at three months post-initiation with emphasis on standardized procedures proved effective in decreasing infection rates.

Keywords: peritoneal dialysis; peritonitis; retraining; continuous quality improvement; nursing management

Introduction

Peritoneal dialysis (PD) is an effective renal replacement therapy. According to USRDS data, PD offers higher early survival rates compared to hemodialysis (especially during the first two years of dialysis), lower costs, and reduced dependence on equipment, facilities, and personnel resources, leading to its rapid development in China. However, peritonitis remains a major threat to PD patients, accounting for % of infection-related complications. PD centers should monitor and regularly review peritonitis episodes to understand center-specific characteristics and implement timely control measures.

Frequent PD-related peritonitis increases hospitalization rates, accelerates decline of residual renal function, causes peritoneal membrane failure, severely impacts quality of life, and represents the direct and primary cause of temporary or permanent PD discontinuation. If nursing education can effectively reduce peritonitis incidence, PD could achieve even greater clinical value. Every PD center should strive to minimize peritonitis rates to the lowest possible level.

The International Society for Peritoneal Dialysis (ISPD) guidelines emphasize that team-based continuous quality improvement (CQI) is critical for PD center success. PD centers should establish CQI teams that meet regularly to analyze center-specific peritonitis characteristics, identify root causes, develop improvement plans, evaluate outcomes, and ultimately institutionalize effective practices. Retraining is a key CQI method that helps reduce peritonitis risk. However, optimal retraining frequency and timing remain unclear. Each center should design retraining protocols based on its specific peritonitis patterns.

1. Materials and Methods

1.1 Patient Selection

We selected maintenance PD patients at The Third Hospital of Hebei Medical University who underwent catheter insertion between [date] and [date] (pre-CQI group) and between [date] and [date] (post-CQI group). All patients received catheter placement at our center and were followed up regularly.

1.2 Retraining Protocol Design

Data Analysis: Following CQI principles, we analyzed peritonitis characteristics, calculated incidence rates, and identified root causes and key risk factors in our center.

Retraining Timing and Content: By analyzing the timing of first peritonitis episodes, we determined the optimal schedule for initial retraining. Content included: peritonitis hazards and prevention knowledge (e.g., summer as high-incidence season requiring enhanced education on bowel health to prevent diar-

rhea and constipation; local water supply conditions emphasizing running water and avoiding towel use), importance of proper exit-site care, characteristics of peritoneal pathogens and antimicrobial resistance. For patients with recurrent peritonitis, we analyzed patterns, assessed vision and manual dexterity, evaluated family support, and developed targeted retraining plans.

The first retraining was scheduled at months after PD initiation, focusing primarily on standardized procedures. Implementation methods included ensuring tight connections between catheter and transfer set, on-site skills assessment (Q&A), re-emphasizing key operation points, and distributing educational materials.

1.3 Statistical Methods

Data were analyzed using SPSS software. Categorical variables were expressed as percentages (%) and compared using chi-square test for fourfold table data. Statistical significance was set at $P < 0.05$.

2. Results

2.1 Pre-CQI Analysis

In the year prior to CQI implementation, our center had continuous ambulatory peritoneal dialysis (CAPD) patients with episodes of peritonitis occurring in patients. Abdominal fluid cultures were performed in episodes, with positive results in cases (positive rate %). The annual peritonitis rate was per patient-month, and % of patients remained peritonitis-free. Among culture-positive cases, staphylococcus aureus accounted for % of episodes and escherichia coli for %. Other pathogens included coagulase-negative staphylococcus, group D non-enterococcus, enterococcus, and fungus.

Of the patients experiencing peritonitis, had their first episode, with a median time of months after catheter placement (range: months). patients experienced two or more episodes, with having a second episode within the same year. The primary causes were: improper environmental disinfection (%) including not wearing masks, inadequate handwashing, lack of daily UV disinfection, and contact contamination; enteric factors (%) such as consuming cold or contaminated food causing diarrhea, predominantly in summer; and other factors (%). Peritonitis led to catheter removal and transition to hemodialysis in cases.

Comparison of peritonitis characteristics before and after CQI

2.2 Post-CQI Analysis

Following CQI implementation, among CAPD patients, episodes occurred in patients. The annual peritonitis rate decreased significantly to per patient-month ($P < 0.05$ compared to pre-CQI). Culture-positive episodes occurred in cases (positive rate %), and % of patients remained peritonitis-free. Among

culture-positive cases, staphylococcus aureus accounted for % and escherichia coli for %.

Of the patients with peritonitis, had their first episode at a median of months after catheter placement (range: months). patients experienced recurrent episodes, with having a second episode within the same year. Peritonitis led to catheter removal in patients.

Post-CQI risk factors shifted: enteric factors became predominant (%), while peritonitis due solely to procedural or environmental factors decreased substantially (%), indicating improved hygiene awareness. However, two episodes involved disconnections between transfer set and catheter, and one case involved operation without mask use, while cases were attributed to cold/contaminated food causing diarrhea.

Comparison of pathogen distribution before and after CQI

Comparison of peritonitis causes before and after CQI

3. Discussion

PD-related peritonitis results from multiple factors including compromised host immunity and disrupted peritoneal defense mechanisms. It remains the primary cause of morbidity and mortality in PD patients. Through systematic monitoring, analysis of infection causes, and CQI implementation, centers can achieve very low peritonitis rates.

The ISPD recommends that center-wide peritonitis rates should not exceed episodes per patient-year, though centers should strive for episodes per patient-year. Additionally, at least % of patients should remain peritonitis-free annually. Prior to CQI, our center's rate was episodes per patient-month with only % peritonitis-free patients. Following CQI, the rate decreased to episodes per patient-month with % peritonitis-free patients, demonstrating substantial improvement.

Training and retraining are crucial for peritonitis prevention, though optimal frequency and content remain debated. Some studies suggest patients within months or beyond months of PD require retraining, with many centers providing retraining only after the first peritonitis episode. Our center developed a tailored protocol based on local peritonitis patterns and nursing staff capacity.

Our analysis revealed that % of first peritonitis episodes occurred within months post-catheterization (median months). Procedural non-compliance alone accounted for % of cases, with % of culture-positive cases being staphylococcus aureus, indicating contact contamination as the primary mechanism. This underscored the need for enhanced training on standard procedures and catheter care. Providing retraining only after the first episode would be too late and disrupt nursing schedules. Therefore, we institutionalized planned retraining at months post-initiation, focusing on standardized procedures through skills

assessment, knowledge Q&A, and educational materials, which significantly reduced incidence.

Post-intervention, the median time to first peritonitis increased to months, with enteric factors becoming the predominant cause while procedural/environmental factors decreased markedly. This shift indicates successful improvement in hygiene practices but highlights the need for enhanced education on summer dietary precautions and appropriate potassium supplementation to reduce enteric infection risks.

Our data also showed some patients experienced recurrent peritonitis within the same year, often with the same causative factors as their initial episode, emphasizing the importance of intensive retraining for high-risk individuals.

In conclusion, through CQI-based development of a rational retraining protocol emphasizing proactive prevention, timely diagnosis, and appropriate treatment, our center achieved significant reduction in PD-related peritonitis. We have institutionalized month retraining as standard practice. However, peritonitis prevention requires continuous, dynamic effort. Current challenges include low culture-positive rates and high enteric contamination, indicating our next focus should be targeted education for enteric peritonitis prevention. Despite technological advances, peritonitis remains a major PD complication, confirming that CQI is a long-term, ongoing commitment.

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

References

[1] YU X Q. Peritoneal Dialysis Therapeutics[M]. Beijing: Scientific and Technical Documentation Press, 2000. (in Chinese)

[2] ZHANG Y, SHI J. Clinical analysis of peritoneal dialysis-associated peritonitis in single center[J]. Clin Res Pract, 2019. (in Chinese)

[3] PIRAINO B, BERNARDINI J, BROWN E, et al. ISPD position statement on reducing the risks of peritoneal dialysis-related infections[J]. Perit Dial Int, 2011.

[4] BERNARDINI J. Training and retraining: impact on peritonitis[J]. Perit Dial Int, 2003.

[5] LIU D, HU M, LI S, et al. Analysis of bacterial spectrum and drug resistance of cases of peritoneal dialysis-associated peritonitis[J]. Clin Med, 2019. (in Chinese)

[6] WENG N, XU J M, TONG M L. Effect of continuous quality improvement on reducing incidence of peritonitis in peritoneal dialysis patients[J]. Chin J Integr Trad Western Nephrol, 2016.

[7] HAN Q F, DONG J, FAN M H, et al. The cause of dropout and hospitalization in peritoneal dialysis patients[J]. Chin J Blood Purific, 2004. (in Chinese)

[8] SARAN R, LI Y, ROBINSON B, et al. US renal data system annual data report: epidemiology of kidney disease in the United States[J]. Am J Kidney Dis, 2015. Suppl 1: Svii, S1-Svii, S306.

[9] LI P K, SZETO C C, PIRAINO B, et al. Peritoneal dialysis-related infections recommendations: update[J]. Perit Dial Int, 2005.

[10] LIU F Y, PENG Y M. Peritoneal Dialysis[M]. 2nd ed. Beijing: People Medical Publishing House Co., 2011. (in Chinese)

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