

Surgical Intervention after Catheter Removal in a Case of Refractory Peritoneal Dialysis-Related Peritonitis

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Key Words

Surgical intervention · Peritoneal dialysis · Peritonitis · Outcome

Abstract

Peritonitis is the most common infection in peritoneal dialysis (PD) and has been noted to be not only a cause of mortality but also the leading cause of technique failure in patients maintained on PD. Appropriate management of peritonitis to improve patient outcome has been the focus of clinical practice. We report a case of refractory PD-related peritonitis with surgical intervention intending to control ongoing peritoneal infection despite aggressive antibiotics and timely catheter removal. Exploratory laparotomy was performed in this case, and an encapsulated abscess in the peritoneal and pelvic cavity was obliterated. Adhesiolysis was done simultaneously. Continuous postoperative peritoneal lavage and drainage were implemented. Symptoms dramatically improved after operation, and indwelling tubes were removed several days later. Finally, the patient recovered and switched to permanent hemodialysis without intra-abdominal complications. Our case suggested that appropriate and timely surgical intervention in refractory peritonitis is necessary for saving lives in certain subgroups of patients. Clearly, well-designed studies with large samples are warranted to explore this issue in more detail.

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Case Presentation

A 43-year-old woman with end-stage renal disease due to glomerulonephritis had been on peritoneal dialysis (PD) for 2 years. The patient had no history of diabetes mellitus, cardi-

ovascular disease, chronic pulmonary disease or chronic hepatic disease and no previous PD-related infections. The patient's condition was generally good. The latest comprehensive evaluation revealed that she was anuric and with adequate solute clearance (Kt/V_{urea} 1.79, creatinine clearance 58.3 l/week), mild anemia (hemoglobin 96 g/l) and acceptable nutrition status (serum albumin 38.1 g/l); daily ultrafiltration was 800 ml. She was not taking any immunosuppressive agents.

She came to our center complaining of mild abdominal pain, cloudy effluent and low fever. Her effluent white blood cell (WBC) count was 130 cells/mm³ with 88% neutrophils. Physical examination showed moderate diffuse abdominal tenderness. The patient was diagnosed with PD-related peritonitis and was admitted. She had no evidence of exit site or tunnel infection. Empirical treatment was started immediately with intraperitoneal cefradine (loading dose 500 mg/l; maintenance dose 125 mg/l) and amikacin (2 mg/kg per exchange, once daily) after effluent culture sampling. However, her clinical manifestation aggravated gradually during the empirical treatment: the patient had high fever and severe abdominal pain; effluent WBC count rose up to 2,180 cells/mm³; peripheral WBC count and C-reactive protein (CRP) increased significantly. No pathogen was identified in the effluent culture on admission. Consequently, the PD catheter was removed on the 6th day, and the patient was put on continuous renal replacement therapy; antibiotics were changed to intravenous imipenem/cilastatin (500 mg/day), vancomycin (800 mg, once every 5 days) and fluconazole (200 mg/day).

However, after catheter removal, her abdominal pain, distension and high fever persisted and deteriorated, and the infection indicators such as CRP increased further. Both blood and catheter tip cultures revealed absence of any growth. Ultrasound showed that there was abdominal and pelvic encapsulated effusion. To eliminate the infection source and control ongoing peritoneal contamination, an exploratory laparotomy was performed on the 18th day. During the procedure, abscess and adhesion in the right abdominal cavity and pelvic cavity were seen. More than 400 ml of purulent effusion was sucked out, and adhesiolysis was performed. After that, peritoneal lavage with povidone-iodine and normal saline was implemented, and 3 indwelling tubes were placed for continuous postoperational peritoneal lavage and drainage. An infusion tube to the middle abdomen was used for continuous peritoneal irrigation with normal saline (2,000 ml/day); for drainage, a low negative pressure draining tube to the right abdomen and a double cannula connected with an electric suction device to the pelvis where encapsulating abscess was located were used. The patient's condition improved dramatically after the operation; her body temperature fell to normal, and abdominal pain subsided. Effusion culture identified multiple organisms (*Acinetobacter baumannii* 50%, *Acinetobacter lowffi* 20% and *Staphylococcus caprae* 30%). Imipenem/cilastatin and vancomycin were continued according to the antibiotics' susceptibility. Three days after the operation (the 21st day), peritoneal irrigation was stopped, and the infusion tube was removed since the effluent became clear, and another 6 days later the drain tubes were also removed. Finally, the patient recovered and was transferred for permanent hemodialysis. The patient has now been on hemodialysis for more than 3 years without any peritoneal complications.

Discussion

Despite advances to reduce the incidence of PD-related infectious complications, peritonitis still remains the leading cause of technique failure in the PD population and an important cause of morbidity and mortality. Poor outcome of patients who suffer from refrac-

tory PD-related peritonitis is a big issue in clinical practice. The International Society for Peritoneal Dialysis (ISPD) guideline recommends appropriate management process and medical treatment of PD-related peritonitis [1]. Timely catheter removal was recommended to improve patient outcome in case of refractory peritonitis. However, in some cases, intractable intra-abdominal infection continues after catheter removal and probably leads to severe abdominal complications, and even more seriously, critical systemic complications as sepsis and death can result from these local complications [2]. Conservative treatment can hardly resolve these severe abdominal complications, and the condition necessitates surgical intervention to improve the patients' outcome.

So far, surgical intervention in refractory PD-related peritonitis besides catheter removal has lacked evidence, and only a few studies have investigated this issue. In a prospective observational study, Peacock et al. [2] observed that 5 in 37 (13.5%) patients with *Staphylococcus aureus*-related peritonitis developed serious abdominal complications; most of them needed laparotomy, but the outcomes were poor, including 2 cases of death and 2 cases of unsolved intermittent small bowel obstruction. A surgical team from the UK reported that 7 in 62 (11.3%) patients with PD-related peritonitis needed a second laparotomy after catheter removal, but the reasons and outcomes were not described [3]. Chang et al. [4] reported surgical intervention due to unrelieved abdominal symptoms and a great amount of turbid ascites after PD catheter removal in 2 cases of *Pseudomonas*-related peritonitis, and both patients survived. Suzuki et al. [5] presented a rare case of peritonitis secondary to colon perforation caused by ingestion of a piece of bamboo in a PD patient; the PD catheter was removed, followed by peritoneal lavage and continuous abdominal drainage, and the patient finally recovered.

It is important to identify which patients developing PD-related peritonitis need surgical intervention. Unfortunately, there has been no consensus on this issue. Generally, if an episode of peritonitis is secondary to acute abdomen such as gastric or intestinal perforation, appropriate procedures should follow surgical principles, and the aim should be effective source control, which refers to drainage of infected foci, controlling ongoing peritoneal contamination and restoration of anatomic and physiological function [6]. The PD catheter needs to be removed concomitantly, as in the case shown by Suzuki et al. [5]. While an episode of refractory PD-related peritonitis is a primary one, the situation can be more complicated. PD catheter removal is recommended by the ISPD guideline since the catheter may be the source of infection, and as a foreign body it can be a barrier to infection control. However, the guideline does not mention any additional procedure to minimize bacterial burden in the abdominal cavity at the time of catheter removal, and it does not provide any recommendations or opinions about management of ongoing and severe intra-abdominal infection after catheter removal. In practice, whether to perform further surgical intervention is determined according to the comprehensive judgment of the patient's individual condition, as well as very cautious balancing between potential benefits and risks, and the decisions are very likely to be various among different doctors.

What we learn from the present case may help us manage these kinds of patients. When the local symptoms show no improvement or even aggravate after catheter removal, doctors should remember to exclude emerging intra-abdominal complications. The manifestations of severe abdominal complications can be heterogeneous [2, 4], including significant purulent exudation, abscess, adhesion, enteric fistula, ischemic or necrotic bowel, toxic colonic dilatation, intestinal obstruction or perforation, and so forth. These situations are more likely to call for surgical intervention. CT scan and ultrasound examination usually can define the site and nature of the infection responsible for the clinical syndrome and guide subsequent intervention.

Further surgical procedures may consist of peritoneal lavage, abscess drainage, debridement, adhesiolysis, etc., determined by the nature of abdominal complication. Though it is difficult to verify the clinical efficacy of peritoneal lavage for the treatment of peritonitis due to lack of studies, we support to perform it if there is a significant amount of purulent ascites or extensive intra-abdomen contamination since a flush to the peritoneal cavity may reduce the bacterial load, inhibit bacterial proliferation and possibly minimize peritoneal adhesions. A meta-analysis on experimental non-PD-related peritonitis reported that the mortality in studied animals with antibiotic lavage, saline lavage, antiseptic lavage and no lavage was 16.4, 48.9, 75.0 and 73.9%, respectively [7], suggesting a preference for treatment options. Drainage converts a closed intra-abdominal infection into a controlled sinus which is to the exterior, and facilitates cleaning of the remaining ascites or postoperative peritoneal exudation. In the present case, we performed continuous peritoneal irrigation and drainage because of the large amount and thick density of the effusion observed during laparotomy. Debridement is necessary when there is ischemic or necrotic tissue, and adhesiolysis is indicated when there is compartment or intestinal adhesion to avoid residuals of capsulated abscess or bowel obstruction.

The risks of surgical intervention for refractory PD-related peritonitis are mainly procedure related, such as bleeding and bowel perforation. In addition, these patients are usually very sick, which might be a significant barrier to anesthesia and invasive procedures. However, if an invasive procedure is indicated, prolonged waiting time before it may be associated with increased likelihood of adverse events. On the other hand, intervention measures as inserting and keeping intra-abdominal drain tubes may increase the potential pathway to unmanageable infection since biofilm may be formed in the tube and become an additional infection source. Therefore, successful surgical intervention calls for definite diagnosis, appropriate timing, experienced surgeon and intensive postoperative care, and before the intervention, supposed benefits should outweigh potential risks.

Furthermore, it would be much more promising if we could find patients who are at high risk of further adverse events. Theoretically, this is associated with the pathogen's properties and patient's individual condition. Outcomes of PD-related peritonitis are closely associated with causative pathogens. Gram-negative organisms, *S. aureus* and fungus are related to poor outcomes of peritonitis [8]. As demonstrated by the teams of Peacock [2] and Chang [4], *S. aureus* and *Pseudomonas* can lead to complicated intra-abdominal complications, while other relatively mild pathogens as coagulase-negative *Staphylococcus* are unlikely to cause such kinds of adverse events [2]. Recent basic research also supports the role of *S. aureus* in forming peritoneal abscess in PD patients [9]. Therefore, more intensive monitoring is needed in patients suffering from peritonitis caused by these organisms. Generally, the majority of the patients developing refractory PD-related peritonitis can be cured by catheter removal in combination with systemically administered antibiotics. However, it was found that a high serum CRP level at 72 h of peritonitis and long PD duration before peritonitis were significant predictors of the development of encapsulating peritoneal sclerosis within 90 days after catheter removal, while effluent WBC at 72 h was associated with the development of recurrent ascites [10]. Patients with peritoneal sclerosis have a higher incidence of postlaparotomy complications [3]. Additionally, the optimal timing of intervention remains unclear and needs further study.

In conclusion, we presented a case suggesting that appropriate surgical intervention for refractory peritonitis is necessary for saving lives in certain subgroups of patients. PD-related infections accompanied by unresolved intra-abdominal complications, or those secondary to intra-abdominal pathology may require further surgical procedures. Clearly, the indication, timing and measures of surgical intervention need further studies.

Disclosure Statement

The authors have no conflicts of interest to disclose.

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