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CASE REPORT

Delayed intestinal perforation associated with peritoneal dialysis: A case report of maintaining dialysis after perforation

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Key Clinical Message

Delayed intestinal perforation has various manifestations. For peritonitis with delayed treatment and multi-bacterial peritonitis, we should be alert to the occurrence of this rare complication. Abdominal CT examination and imaging results judgment based on clinical conditions are particularly important for diagnosis. Delayed intestinal perforation of peritoneal dialysis catheter is a rare but serious complication. We reported a 49-year-old patient who had been hospitalized twice within 3 months due to poor drainage of the peritoneal dialysis catheter. During the first hospitalization, peritoneal dialysis-related peritonitis was diagnosed, and a variety of bacterial infections were cultivated. However, at that time, the actual peritoneal dialysis catheter-related intestinal perforation was missed, and he was discharged after anti-infection treatment until a clinical cure was met. After more than 2 months of normal peritoneal dialysis after returning home, the patient again had poor drainage of the peritoneal dialysis catheter, accompanied by the outflow of yellowish-brown sediment. It was found that the peritoneal dialysis catheter had evidence of intestinal perforation. After the removal of the catheter and intestinal repair, he recovered and was discharged from the hospital and received long-term hemodialysis treatment. In the case of delayed intestinal perforation, peritoneal dialysis was maintained normally for more than 2 months, which was an unprecedented situation in previous case reports. In addition, we should be alert to the occurrence of this rare complication, especially when we find the occurrence of polybacterial Peritonitis. Abdominal CT examination and imaging results judgment based on clinical conditions are particularly important for diagnosis.

KEYWORDS

bowel perforation, PD catheter, Polybacterial peritonitis

1 | INTRODUCTION

Peritoneal dialysis (PD) is a widely accepted alternative treatment for end-stage renal disease. Delayed intestinal perforation is a rare but serious complication of PD. In recent years, a small number of case reports have also improved our understanding of this rare complication, but the diagnosis is still delayed due to the heterogeneity and concealment of clinical manifestations. Here we reported a patient with a delayed diagnosis of intestinal perforation due to a misdiagnosis in imaging at the initial visit. However, the patient's presentation of multibacterial peritonitis at the time was well cured through clinical anti-infection treatment, and he even continued to undergo normal PD for more than 2 months. He was diagnosed with delayed intestinal perforation and received treatment until he returned to the hospital with abnormal PD drainage. To our knowledge, there have been no previous reports of delayed intestinal perforation in similar situations.

2 | CASE PRESENTATION

A 49-year-old man was hospitalized in our department in March 2020 after finding abnormal renal function due to chronic glomerulonephritis for more than 1 year. His creatinine was 519 umol/L and the glomerular filtration rate was 10.43 mL/(min·1.73 m2). He was diagnosed with chronic kidney disease stage 5 and chose PD as a long-term renal replacement way. On March 2, 2020, he received open PD catheterization, Tenckhoff PD tube and double cutoff straight tube. About 1 week after the operation, he started PD treatment, using a 1.5% concentration of PD fluid, four times a day, and taking the Continuous ambulatory peritoneal dialysis (CAPD) treatment plan. The daily ultrafiltration volume was 550-600 mL and his urine volume was about 800 mL/day. Then he was discharged from the hospital in stable condition, and continued regular PD daily. During the PD process about half a year after discharge, the patient described that the color of the dialysate was clear and normal, and there was no complaint of poor drainage of the dialysate. Normal ultrafiltration was about 200-300 mL/day, and the urine volume was about 800 mL/day. No abnormal performance was found during follow-up in the patient's intermittent PD clinic.

About half a year later (November 3, 2020), he suffered from abdominal pain and diarrhea after eating unclean food, accompanied by slow drainage and turbidity of PD fluid. The community hospital gave him cephalosporin anti-infection treatment, and he felt that his symptoms had improved without further attention and treatment. Two weeks later, the patient experienced abdominal pain with diarrhea and watery stools again. The PD fluid was cloudy, and the drainage of the PD fluid was slow and contained flocculent substances. No abnormal changes in fecal residue were observed. The PD tube is repeatedly blocked. Subsequently, he came to our hospital for a medical examination. At the time of examination, the abdomen was soft, with tenderness but no rebound pain. PD fluid examination (November 25, 2020) showed 103 nucleated cells, with a cell classification of 80.6%. He was admitted to continue treatment. The PD fluid culture sequentially displayed Pseudomonas aeruginosa, Enterobacter cloacae subspecies, Klebsiella pneumonia, Enterococcus, and Streptococcus salivarius. Due to the cultivation of multiple bacterial infections, clinical physicians have become more vigilant about the possibility of other abdominal problems, such as intestinal perforation, and have arranged abdominal CT scans. The examination results only indicate peritonitis-like changes without reporting the presence of intestinal perforation or another acute abdomen. So, in clinical treatment, according to the cultivated drug sensitivity results, patients were given intraperitoneal anti-infection treatment with cefazolin and amikacin, and the effect was good. The number of nuclear cells in the patient's PD fluid quickly returned to normal, with abdominal pain and diarrhea and improved drainage of PD fluid. Due to the patient's mild abdominal examination symptoms at the time, the absence of reported intestinal perforation in abdominal imaging reports, and the good results achieved in clinical experience of anti-infection treatment, we did not further suspect the existence of intestinal perforation. The patient had a 2-week medical history, and various bacteria were cultured before the visit. We conducted a total of 3 weeks of anti-infection treatment. After the clinical cure of peritonitis, he was discharged from the hospital. Then, he continued to receive regular PD treatment every day, without any obstruction of the dialysis tube or abnormal dialysate without abdominal discomfort such as pain and diarrhea. The ultrafiltration volume was approximately 200–300 mL/day, similar to before hospitalization, and the urine volume was 700–800 mL/day. His last follow-up was on February 1, 2021, at our PD clinic. The outpatient doctor recorded that his PD drainage and PD fluid were typical then.

More than 2 months after the follow-up (March 17, 2021), the patient again suffered from obstruction of the drainage tube of the PD catheter, accompanied by edema and shortness of breath for about 10 days, no obvious abdominal pain and fever, and intermittent watery stool. He went to the Eighth Affiliated Hospital of Sun Yat-sen University for treatment. Upon admission, his PD tube was drained of yellow-green turbid liquid with a large amount of brown sediment. Abdominal CT examination showed that the middle and distal ends of the PD tube

located in the small intestine tube of groups 5–6, with a range of about 94 mm (Figure 1). The diagnosis considered delayed intestinal perforation of a PD catheter. At that time, the patient had symptoms of heart failure, so he first performed emergency hemodialysis to improve the symptoms, and then performed laparotomy. During the operation, it was found that the PD catheter penetrated the fifth segment of the small intestine, and its end stayed in the intestinal cavity about 14 cm long (Figure 2), with obvious adhesion to the intestine, which confirmed the delayed intestinal perforation. The surgeon removed the catheter and sutured the local perforation. After the surgery, systemic anti-infection treatment was continued, and the patient's condition recovered well without any other abdominal complications. The patient was adjusted to long-term hemodialysis treatment. Afterward, the patient's condition was good during the follow-up period of hemodialysis treatment for over a year, and there were no further abdominal complications.

3 | DISCUSSION AND CONCLUSIONS

Delayed perforation of the intestine is a rare complication of PD and the earliest case was reported by Watson in 1980.[1] Up to now, the occurrence of catheter-related delayed intestinal perforation is still very rare, and only about 40 cases have been reported. The site of perforation can affect the whole intestine, and the sigmoid colon is the most common perforation site reported.[2] In addition, the small intestine, rectum, and other parts are relatively rare, and there are few cases reported in the past[3]. The clinical manifestations of delayed perforation were different, including peritonitis, watery diarrhea, poor drainage, catheter prolapse from the anus, etc.[4] Treatment includes supportive treatment, open surgery or laparoscopic catheter removal, catheter removal under colonoscopy, surgical closure or nonclosure of perforation sites are mentioned.[5–8]

Reviewing the medical history of our patient, the time of his second illness was so close, and the second hospitalization confirmed that he had such a rare complication, which attracted our attention. We reviewed the abdominal CT imaging data of the patient when he was hospitalized for the first time due to PD-related peritonitis, and we were surprised to find that the patient had an intestinal perforation of the PD catheter at that time. Reading the image pictures, it is suggested that the PD catheter perforated at the position of the right middle abdominal small intestine, with a length of 60–70 mm, and tightly adhered to the surrounding intestinal tissues. (Figure 3) The CT report at that time had missed diagnosis, and the patient had already had complications of delayed intestinal perforation associated with a PD catheter at the first admission. Looking back, this patient had some unusual peritonitis characteristics during his first visit to our hospital. Firstly, he had a long history of peritonitis but did not receive timely and standardized treatment before coming to our hospital. Secondly, the patient's peritoneal dialysate culture indicated multiple bacterial peritonitis. However, due to the missed diagnosis in imaging and the good results of subsequent clinical treatment, we missed the diagnosis of delayed intestinal perforation that existed at the time during the first patient's diagnosis and treatment. This also reminds us that when patients experience a long course of untreated peritonitis and exhibit multi-bacterial peritonitis, we need to consider the rare complication of delayed intestinal perforation. Abdominal CT examination and imaging results judgment based on clinical conditions are particularly important for diagnosis. In addition, it is also essential for clinical doctors to enhance their imaging reading abilities during the diagnosis process, as well as for interdisciplinary cooperation

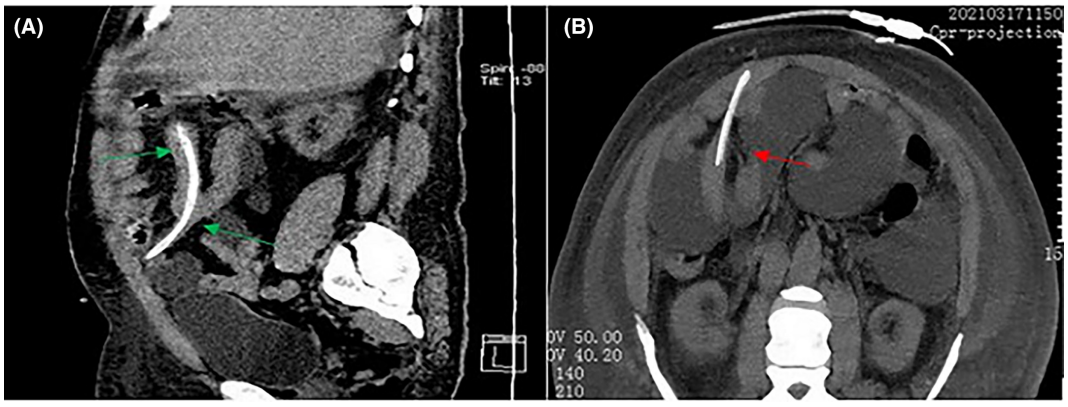

FIGURE 1 During the second peritonitis hospitalization, computed tomography showed that the catheter penetrated the small intestine. (A) Sagittal section: The catheter enters the small intestine (arrow). (B) Coronal section: The catheter passes through the intestinal wall (arrow).

and communication in the diagnosis and treatment of rare diseases. Reviewing current literature, the diagnosis of delayed intestinal perforation can be confirmed through clinical manifestations, plain abdominal films, abdominal CT, PD catheter angiography, colonoscopy, or laparotomy.[4,9,10] When abdominal CT or abdominal X-ray cannot detect or diagnose perforation, PD catheter iodine contrast agent and methylene blue transabdominal catheter contrast agent can further assist in diagnosis.[4,11]

The cause of delayed intestinal perforation related to PD catheters is still unclear. The previously reported risk factors for PD catheter to intestinal perforation include the use of immunosuppressants, the presence of diverticulitis,[12] colon amyloidosis,[5] the prolonged suspension of PD catheter without removal,[3] the operation mode of PD catheter placement,[13,14] and the associated factors that increase abdominal pressure, such as polycystic kidney.[4] Our patient did not have these risk factors mentioned in previous studies. However, it is worth noting that the patient received nonstandard peritonitis treatment 2 weeks before the first occurrence of peritonitis and received standardized treatment in our hospital. This suggests that the prolonged course of peritonitis may also be a factor in the occurrence of this complication, as seen in the abdominal CT images of the patient during their first hospitalization. The patient's PD catheter has severe adhesion to the intestinal wall, and perforation may occur after the adhesion. In addition, the patient in our case cultured a variety of bacteria at the time of the first peritonitis, which may be related to the translocation of a variety of bacterial populations in the intestine of patients with delayed intestinal perforation at that time. Polymicrobial peritonitis in PD patients was previously considered to be related to gastrointestinal diseases and gastrointestinal perforation. It is relatively difficult to treat clinically and often has a poor prognosis. Reviewing the cases of delayed intestinal perforation reported so far, Abigail W. Cheng[11] and Olivier Moranne[15] also cultured a variety of different bacteria. We suspect that in patients with PD-associated peritonitis if there are possible related clinical features previously suggested, such as poor drainage of a PD catheter, watery diarrhea, etc., plus a variety of bacteria cultured, we need to be highly alert to the occurrence of delayed perforation.

In retrospect, the patient continued PD for more than 2 months based on there was delayed intestinal perforation, but there was no discomfort. It has not been reported in previous cases. Combined with the location and depth of the perforation of the PD catheter in the previous and second abdominal CT during the process of the patient's disease, and the PD catheter we saw during the operation did not penetrate the small intestine. We considered the reason why peritonitis can be clinically cured and continue to be treated with normal PD for more than 2 months based on perforation of the PD catheter may be that the distal drainage hole of the catheter that enters the intestinal cavity of the small

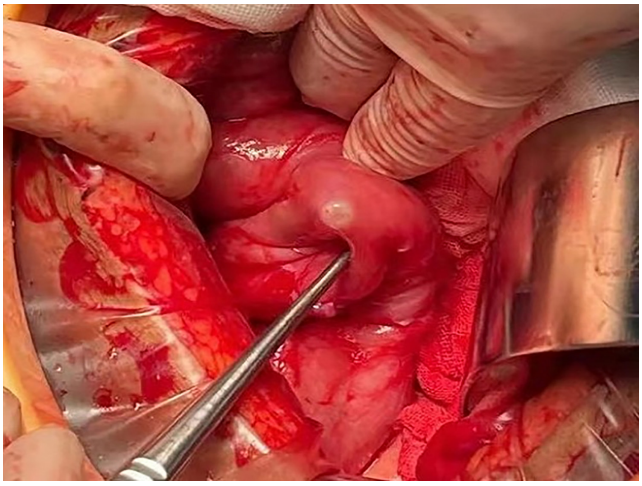

FIGURE 2 Location of delayed perforation of peritoneal dialysis catheter during operation.

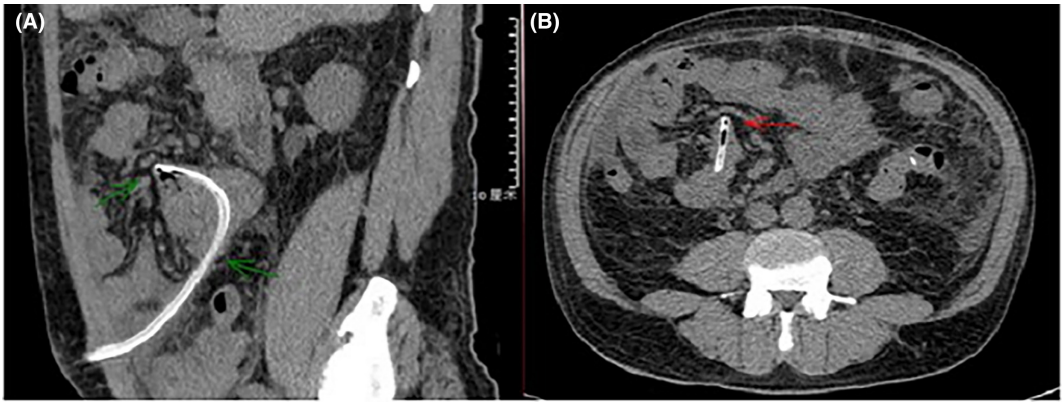

FIGURE 3 Abdominal computed tomography showed a catheter penetrating the small intestine during the first peritonitis hospitalization. (A) Sagittal section: The catheter enters the small intestine (arrow). (B) Coronal section: The catheter passes through the intestinal wall (arrow).

intestine is blocked by fibrous tissue to form a dead cavity and the dialysis catheter that penetrates the intestinal cavity forms adhesion with the surrounding intestine, so that the intestinal cavity is not connected with the abdominal cavity and the intestinal contents do not flow into the peritoneal cavity to form peritonitis or make peritonitis challenging to control. However, the PD catheter in the abdominal cavity maintains the drainage through the side hole so that PD remains normal. It may be similar to the previously reported situation of patients with delayed intestinal perforation of PD catheter without obvious clinical symptoms.[8,16] After more than 2 months, the patient again suffered from poor drainage of PD fluid and a large amount of brown sediment. We considered that at this time, the PD catheter may further enter the intestinal cavity to reduce the original side-hole drainage. This can be confirmed by the fact that the length of the PD catheter in the intestinal cavity seen in the second abdominal CT examination is about 94 mm, which is deeper than the length of 60–70 mm in the first; In addition, the fiber tissue in the distal drainage hole may fall off at the same time, leaving a gap in the originally closed dead cavity, and the intestinal contents may flow out. This also reminds us that in clinical practice, patients who experience recurrent peritonitis in the short term need to consider this form of delayed intestinal perforation.

In conclusion, delayed intestinal perforation has various manifestations, and our case shows that sometimes the clinical cured of peritonitis cannot completely rule out the occurrence of this rare complication. For peritonitis with delayed treatment and multi-bacterial peritonitis, we should be alert to the occurrence of this rare complication. Abdominal CT examination and imaging results judgment based on clinical conditions are particularly important for diagnosis.

AUTHOR CONTRIBUTIONS

Ru Zhou: Writing – original draft. **minhong Luo:** Investigation; writing – review and editing. **Hairong Tang:** Investigation; visualization. **Tiecheng Yang:** Investigation; visualization. **hualin Ma:** Investigation; writing – review and editing. **zhen Wang:** Investigation; writing – review and editing. **xinzhou Zhang:** Investigation; writing – review and editing. **baochun Guo:** Conceptualization; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

ETHICS STATEMENT

This study protocol was reviewed and approved by Ethics Committee of Shenzhen People's Hospital, approval number LL-KY-2023016-01. Written paticipate statement was obtained from the patient.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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