Resumption of Peritoneal Dialysis by Externalization of the Embedded Catheter: A Case Report

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Abstract
We previously reported a re-embedding catheter technique for peritoneal dialysis (PD) patients with high risk of catheter removal at the discontinuation of PD. We recently operated on a 50-year-old female patient who had resumed PD by externalization of the catheter after the re-embedding catheter technique. The patient had been on PD for acute kidney injury (AKI) due to a hypertensive emergency in 2009, but had discontinued PD after seven months because her creatinine levels decreased to 2 mg/dL. However, because her renal function did not normalize and she preferred to undergo PD for future renal replacement therapy, we applied the re-embedding catheter technique. She resumed PD by externalization of the catheter four years later. We consider the re-embedding catheter technique a useful method for AKI patients who do not recover normal renal function.

Key Words
Peritoneal dialysis, resumption, re-embedding catheter technique, acute kidney injury

Introduction
The treatment for end-stage renal disease (ESRD) is hemodialysis (HD), peritoneal dialysis (PD), and kidney transplantation. Since the opportunities for kidney transplantation are limited in Japan, dialysis therapy is of crucial importance, both from medical and social viewpoints. Consequently, PD has been applied as a self-care and home-based procedure for patients with ESRD and has contributed to restoring and maintaining patients’ social and family lives.

According to the Japanese Society for Dialysis Therapy report in 2014, the mean age of new dialysis patients is approximately 70 years¹. Therefore, many patients have a variety of complications and are frail at the initiation of dialysis. We previously reported the re-embedding catheter technique for elderly PD patients who are at high risk for removal of the peritoneal dialysis catheter (PDC)². The procedure can also be adapted to patients who must be transferred from PD to HD, and hope to resume PD at a later date, so that they may spend their end of life at home. However, most patients in whom the re-embedding catheter technique was performed were transferred to HD without resumption of PD due to their inability to self-manage their dialysis. In contrast, we operated on a younger patient in whom PD could be resumed by externalization of the catheter that was embedded at the time of PD discontinuation. We now report on this case, because there have been no reports of resumption of PD by externalization of the embedded catheter.

Case description
A 50-year-old woman had been on treatment for hypertension with amlodipine (10 mg/day) since 2007. However, after one year, she had become un-
able to visit the hospital for more medication due to work constraints. She began to suffer from headaches and vomiting in December 2008. In addition, she visited our hospital for lightheadedness, and in January 2009, she was diagnosed with acute kidney injury (AKI) due to a hypertensive emergency (blood pressure 280/150 mmHg, serum creatinine 4.83 mg/dL). At this time, percutaneous oxygen saturation, body temperature, and pulse rate were 99% (on room air), 36.7°C, and 80 beats/min, respectively. Although she had moderate bilateral edema in the lower extremities, she had no other symptoms, such as respiratory discomfort, or abnormal neurological findings. Abdominal and cranial computed tomography did not indicate obvious renal atrophy or cerebral hemorrhage. Additionally, hypertensive retinopathy was absent on fundus examination.

Oral nifedipine (60 mg/day) and doxazosin (4 mg/day) were immediately administered. Thereafter, although her blood pressure promptly improved to 150/100 mmHg, her renal function deteriorated over the next two weeks (serum creatinine 8.52 mg/dL). HD was initiated by inserting a temporary double lumen catheter due to the presence of uremic symptoms such as nausea and general fatigue. Hospitalization and HD for one month resulted in maintenance of her urine volume and no further deterioration in serum creatinine. We provided her with information on modalities of maintenance renal replacement therapy. She selected PD because she wanted to continue working in the future. Consequently, mini laparotomy was performed to insert a Swan Neck Sendai Catheter, JB-5(A) (Hayashidera Co. Ltd., Ishikawa, Japan) as the PDC. She was discharged within a month after surgery. Three months after discharge, her renal function gradually improved (approximate serum creatinine 2.0 mg/dL), and she was able to discontinue PD at five months after the initiation. However, her renal function still did not completely recover to normal levels. Hence, according to the re-embedding catheter technique, we buried the catheter subcutaneously rather than removing it, in case of the future need for PD as renal replacement therapy. The procedure of the re-embedded catheter technique is shown in Figure 1. Four years after the discontinuation of PD, she again complained of a loss of appetite and general fatigue. Evaluation revealed that her renal function had gradually worsened again (serum creatinine 7.15 mg/dL). Therefore, we decided to resume PD. The clinical course is shown in Figure 2.

Under antibiotic prophylaxis and aseptic conditions, a small skin incision (3 cm) was made to expose the catheter. The catheter was flushed with saline to confirm its patency. Despite the prolonged period for which the catheter had remained embedded, it was still patent. A titanium extender (Hayashidera Co. Ltd., Ishikawa, Japan) was used to connect the embedded and new catheters, and both ends were tied with 3-0 nylon yarn (Akiyama Medical Mfg. Co. Ltd., Tokyo, Japan). A PDC similar to the initial one was used. The new catheter was externalized at an appropriate site through a new subcutaneous tunnel using a tunneling tool (Figure 3). All procedures were performed under local anesthesia.

![Preoperative image](image1.png) ![Postoperative image](image2.png)

**Figure 1.** Procedure of re-embedded catheter technique. 1: Diagram showing the peritoneal dialysis catheter configuration before and after re-embedding. 2: A small incision is made at the abdomen under local anesthesia, the subcutaneous cuff is exposed, and the peritoneal dialysis catheter is cut below the subcutaneous cuff. 3: The residual peritoneal dialysis catheter is embedded under the skin.
Figure 2. Clinical course. The change of serum creatinine level and modality of dialysis is shown. HD: hemodialysis, PD: peritoneal dialysis

Figure 3A. Preoperative view. To determine the best location of exit site, it is necessary to mark the desired location for the catheter’s exit site (exit site: white allow; incision site: black allow). Exit sites should be avoided at the belt line.

Figure 3B. Postoperative view. Titanium extender was used to connect the re-embedded catheter with the new PDC. The new catheter was externalized at an appropriate site through a new subcutaneous tunnel using a tunneling tool.

Resumption of abdominal X-ray image is shown in Figure 4.

PD was resumed immediately after surgery, and the patient was discharged within one week. PD was prescribed for six hours at each treatment, based on a 1.5-L (glucose-based peritoneal dialysis solution) dwell volume, and the frequency of exchange was three cycles. At present, approximately two years since resumption of PD, the patient has been able to continue the therapy uneventfully. We obtained the patient’s consent to publish her case report.

Discussion

PD can be initiated for AKI patients who require an urgent dialysis. Hypertensive emergency is defined as a severe elevation in BP (>180/120 mmHg) associated with evidence of impending or progressive target organ dysfunction, including AKI, encephalopathy, and/or acute myocardial infarction\(^5\). Although strict control of blood pressure with antihypertensive therapy does improve the prognosis of these patients, some do still need dialysis therapy\(^6\). The advantages
of PD over HD for AKI are avoidance of temporary vascular access and heparinization, and hemodynamic stability. In addition, PD can be performed despite relative hypotension. In AKI patients requiring urgent dialysis, placement of a PDC provides an acute dialysis access port that can also be used for chronic PD. Furthermore, if the patient’s renal function does not recover to normal levels, the embedded PDC serves as a future renal replacement therapy option in AKI patients.

We often experience situations where it is not possible or difficult to continue PD due to serious complications (such as cerebral hemorrhage and infarction). In such cases, it is common practice in Japan that patients switch to HD with removal of the PDC. It is common practice that PDC is removed at discontinuation of PD. However, removal of the PDC creates a heavy burden, in the form of general anesthesia and open surgery, on these patients who already have serious complications. Therefore, at our institution, we apply the re-embedding catheter technique for patients who have a high risk with PDC removal or for those who prefer to resume PD rather than HD if the need arises. We adopted the re-embedding catheter technique in this patient because her renal function did not recover to normal, and she wished to be treated with PD as renal replacement therapy if her renal function deteriorated again in future.

The procedure for embedding a PDC was described by Moncrief et al. in 1993. While Moncrief’s procedure is used before the commencement of PD, the re-embedding catheter technique is performed at the end of PD. The re-embedding catheter technique is less invasive and, is performed at a lower cost. Therefore, this technique is not associated with any major complications (such as intra-abdominal injury and abdominal incisional hernia) and does not need spinal or general anesthesia. However, as with Moncrief’s procedure, the risk of PDC obstruction is enhanced by a longer embedding period. Brown et al. reported that the proportion of PDCs to primary failure was significantly higher in patients in whom the catheter had been embedded for five months longer, compared to those in whom it was embedded for a shorter time. In addition, there are concerns about local infection and peritonitis due to the indwelling PDC. Pollock et al. reported that the PDC itself is a risk factor for encapsulating peritoneal sclerosis. In our facility, we have not yet, experienced local infection, peritonitis, or encapsulating peritoneal sclerosis as a result of this technique.

In this case, a titanium extender was used to connect the re-embedded catheter with the new PDC. Titanium extenders are essentially used to repair or extend the external portion of the PDC. We previously reported partial surgical replantation as a treatment for refractory exit site and tunnel infection. In this case, we created a new subcutaneous tunnel and exit site under local anesthesia by applying this technique.

**Conclusion**

We applied the re-embedding catheter technique at the discontinuation of PD for a patient with partially recovered AKI. Four years after this procedure, she developed end stage renal disease and was able to resume PD by exteriorization of the PDC. We consider that the re-embedding catheter technique can be adopted not only for patients with the risk of PDC removal, but also for patients who are at a high risk for requiring renal replacement therapy in the future.

**Disclosures:** The authors do not have any conflicts of interest to declare.

**Abbreviation List:** ESRD: end-stage renal disease, PD: peritoneal dialysis, HD: hemodialysis, PDC: per-
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References


