Original Article

A novel method for salvage of malfunctioning peritoneal dialysis catheter

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Abstract

Context: Continuous ambulatory peritoneal dialysis (CAPD) has been widely used as an effective therapy in the management of patients with end-stage renal disease. Long-term use of CAPD needs methods with low incidence of catheter-related complications. Moreover, some complications may cause failure of fluid drainage and treatment interruption.

Aims: We have innovated and studied a new minimal-invasive method of malfunctioning peritoneal catheter repair.

Materials and Methods: Thirty-five patients agreed to undergo catheter rescue operation by this new method during 2004 and 2012. Under local anesthesia and light sedation, access to the abdominal cavity was made, the catheter and wrapped omentum grasped and the tip of catheter was released, debris were removed and the catheter was directed toward the pelvic floor with a finger guide. The patients were followed after catheter salvage up to the end of study (April 2012). PD catheter function restored to the normal level in 28 (80%) of patients, and PD was started 1-2 days after the procedure.

Results: All patients had an uneventful recovery. PD catheter function was restored to the normal level in 28 (80%) patients, and PD was started 1-2 days after the procedure. Of these patients, 10 (35%) died of reasons unrelated to catheter or catheter complications; 7 (25%) were ultimately referred for kidney transplant; 8 (29%) continued PD up to the end of this study with no problem, and only 3 (11%) due to catheter complications. Catheter function did not restore to the normal level in seven patients (20%); however, six patients continued PD for 1-18 months with the catheter.

Conclusions: Comparing the advantages and disadvantages of this method to the previous laparoscopically repaired catheter, we concluded that this new method is efficient, and is a suitable way for malfunctioning PD catheter salvage.

Key Words: Catheter malfunction, catheter rescue, continuous ambulatory peritoneal dialysis, minimally invasive surgery, peritoneal dialysis

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INTRODUCTION

Continuous ambulatory peritoneal dialysis (CAPD) has been widely used as an effective therapy in the management of end-stage renal disease.[1,2] This method provides better mobility and less dietary restrictions compared to hemodialysis.[3] Successful and long-term use of CAPD needs methods with low incidence of catheter-related complications.[4,5] Some peritoneal-catheter-related complications such as accumulation

of debris within the catheter lumen, migration of catheter tip, and omental wrapping may cause failure of fluid drainage.[2,6-8] When conservative treatments fail to restore catheter drainage, catheter repositioning is necessary.[8,9] Conventional surgery requires general anesthesia and is related to further pain, mechanical and infectious complications, and increased hospitalization.[10,11] Laparoscopic revision has been widely used for salvage of malfunctioning catheter.[12-15] Despite several advantages, this method has some disadvantages such as postoperative pain and immobility besides straining the financial resources.[16-18] Given the medical problems of patients with renal failure, simple and quick methods are preferred. Therefore, we have innovated and studied a new minimally invasive method of malfunctioning peritoneal catheter repair. This method can be performed to provide a quick, safe, and reliable peritoneal access.

MATERIALS AND METHODS

The present study was conducted in the Department of Vascular Surgery at an Educational University Hospital, Isfahan, Iran, during 2004 and 2012. Forty-six of 286 patients, who were implanted peritoneal dialysis (PD) catheter by conventional open surgery had PD catheter malfunction and were enrolled in the study. Catheter malfunction was considered when normal or reduced inflow was accompanied with slow drainage or no drainage of infused dialysate. Inclusion criteria were patient's consent, self-care ability and having a supportive family for choosing this method and being over 18-year-old age. Exclusion criteria were morbid obesity (BMI>35 kg/m^2), ventral or inguinal hernia, or any history of abdominal surgery, except implanting the PD catheter. Conservative treatment (washing of the catheter for fibrin deposition, antibiotic therapy for infectious complications of the catheter) of malfunctioning catheter was given as the first step of treatment if possible. Only those patients whose conservative treatment failed or had omentum wrapping, adhesions, or disposition of the tip of the catheter were enrolled the study. Before the operation, an abdominal X-ray interestingly, confirmed the migration of PD catheter to upper abdomen in all 39 cases.

Four patients did not agree to re-operation to repair the PD catheter and decided to start hemodialysis. The remaining 35 patients with malfunctioning PD catheter were admitted to our hospital to restore catheter function by the introduced new minimally invasive method. This study was approved by the ethics committee of Isfahan University of Medical Sciences and informed consent was obtained from all patients.

Procedure

Patients were placed in the supine position, given 1 g of Keflin® intravenously. After prep and drep, under the local anesthesia with Lidocaine and a light sedation with Midazolam and Ketamine, a 1-cm-long midline sub-umbilical incision was made through the skin, subcutaneous tissue, and fascia. To provide a better access to the abdominal cavity, fascia was more dissected up to 1.5-2 cm. Then, the catheter and wrapped omentum were seen and grasped by a Babcock. Tip of catheter was released from the omentum and other soft tissues; clots and debris were removed by milking the catheter; in addition, 200 ml normal saline was injected into the catheter. Partial omentectomy was performed, the omentum was removed through the incision, and each bite was ligated by absorbable Vicryl 3-0. After that, the catheter was directed toward the pelvic floor with a finger guide, the fascia and skin were closed with sutures (with Nylon 0 and 3-0, respectively). The place of the catheters after surgery was checked by plain X-ray.

Adequacy of dialysis was measured by Kt/V 1 week after catheter repair to evaluate the efficiency of PD. Here, 'Kt' represents the volume of fluid purge of urea during a single period of treatment and 'V' represents the total body water of the patient. Kt/V values equal to or more than 1.7 were considered as normal.[19,20]

RESULTS

PD catheter was implanted for 286 patients by conventional open surgery over an 8 year period. During a 50.45 ± 23.34 months follow up, 46 (16.08%) patients had PD catheter malfunction. In three cases, after washing of the catheter for fibrin deposition or antibiotic therapy for infectious complications, catheter function restored to normal. Four cases have BMI greater than 35 kg/m[2] and were not proper for doing this method. So, 39 cases were candidate for this novel technique; however, 4 patients decided to have no more surgery and start hemodialysis. Non-infectious catheter complications including external leak, internal leak, and hemoperitoneum were recorded in seven, one, and two patients, respectively. Regarding infectious complications of the catheter, four patients had peritonitis and catheter exit site infection while two patients had only peritonitis and one had only catheter exit site infection. All these cases were treated with appropriate topical and systemic antibiotics.

Minimally invasive PD catheter repair was performed on the patients including 24 men and 11 women. Patients were aged from 19 to 82 (mean ± SD: 51.51 ± 20.60 years). Mean BMI was 22.54 ± 4.41 (range: 14.48-38.02). Regarding the cause of renal failure, two major causes were include hypertension in 17 (49%) and diabetes mellitus in 12 (34%) patients.

The operating time was 10-15 minutes. The proper placement of the catheters was confirmed by plain X-ray in all cases

after surgery. All patients had an uneventful recovery. The patients asked to report their pain experience using a numbers from 0 to 10. Post-operative pain was easily managed by oral analgesics without needing to intravenous analgesics, and patients were discharged one day after the operation. In patients whose catheter function was restored to normal, PD restarted 1-2 days later. Neither surgical mortality, nor visceral organ damage occurred. Patients were followed for 35.65 ± 23.12 months.

Re-operation outcomes

A general view of the study is summarized in Figure 1.

Patients with normal catheter function after repair

PD catheter function restored to the normal level in 28 (80%) of patients, and PD started 1-2 days after the procedure. These patients were followed after the surgery up to the end of this study for 19.77 ± 21.48 months (range: 2-90 months). Mean Kt/v was 2.02 ± 0.54 in these patients. Table 1 represents outcomes of the patients with normal catheter function after repair.

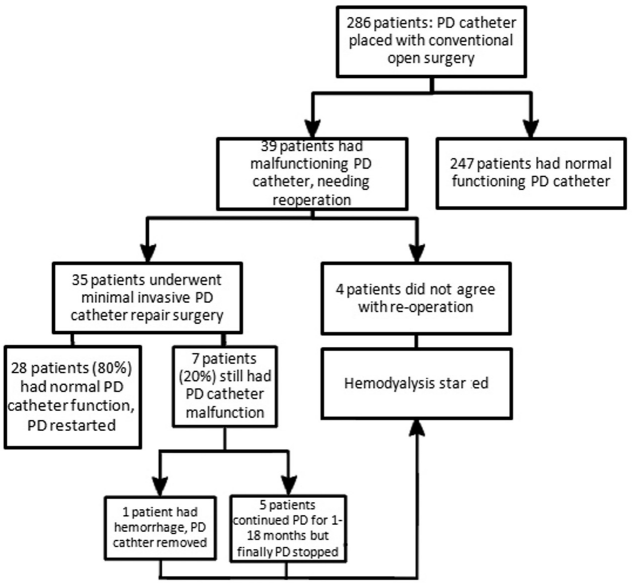

Figure 1: Summary of patients' outcome

Table 1: Outcomes of the patients with normal catheter function after repair

Patient's Outcome	*N* (%)	Mean Kt/V	Mean follow-up duration (months)
Normal function of the catheter	8 (29)	2.12±0.59	37.87±25.05
Kidney transplantation	7 (25)	2.01±0.56	12.85±21.36
Catheter removal*	3 (11)	1.95±.051	18±10.8
Death**	10 (35)	1.97 ±0.49	20.4±20.33

*Due to complications: Two cases of drug resistant infection, and one case of fluid leak after an abdominal hernia repair, **Deaths were unrelated to catheter malfunction or catheter complications

Patients with persistent catheter malfunction after repair

Catheter function did not restore to the normal level in seven patients (20%). One patient had hemorrhage; although it was controlled by conservative measures, catheter was removed and hemodialysis commenced. Despite having some problems with catheter, other six patients continued PD for 1-18 months, but finally they were shifted to hemodialysis.

DISCUSSION

Continuous ambulatory PD is known as an effective method of therapy for patients suffering from end-stage renal disease. Both medical and social benefits, such as better patient outcome, easier blood pressure control, more flexible life style, and lower cost than hemodialysis have made this method widely acceptable.[21,22]

However, malfunction of the PD catheter is still a common problem.[22] Mechanical outflow obstruction is a major cause of treatment interruption in these patients. Catheter misplacement at operation, omental wrapping, catheter migration, and adhesion may result in early or long-term catheter malfunction.[8,23-25] Catheter-related problems are blamed for up to 20% of patient transfers to hemodialysis.[5] If conservative measures fail to solve the problem, other treatment option should be considered. Different open or laparoscopic procedures have been developed for catheter rescue.[8]

Dialysis is vital for patients with renal failure; in addition, they have special condition because of uremia itself and other probable contemporaneous diseases (diabetes mellitus, hypertension and other cardiovascular problems). These patients are usually classified as ASA classification status three or four.[26] Therefore, less invasive procedures with less need for general anesthesia is preferred. The presented method is a suitable way to repair catheter malfunction in this regard. Unlike open surgery and laparoscopy that need general anesthesia, this method is performed under light sedation and local anesthesia.[8] Hence, this new method which has none of the risks associated with general anesthesia can be used safely for almost all patients with PD catheter malfunction.

Compared to laparoscopic revision, operating time is significantly shorter in this method. This is an important advantage if we factor in the special condition of uremic patients.

In this method we made only one 1.5-2 cm cut in the fascia which is smaller than the cut length in the open and laparoscopic operations; therefore, healing process is quicker.

So, patients could resume the routine PD sooner. Eighty percent of our patients were able to restart routine PD 1-2 days after the operation with a satisfactory Kt/v level. In laparoscopic manipulation of the catheter, PD is restarted with lower volume in 24 hours after the surgery but the normal PD resumption may be postponed for 2-10 days of the procedure.[8] Disadvantages of laparoscopy is need for general anesthesia in most patients, the requirement of an operating theater, the cost of equipment and instrumentation, the long duration of the operative procedure, and the adverse physiologic effects of CO_2 pneumoperitoneum.[27]

In laparoscopic omentectomy, the duration of the operative procedure is too long. The gaps among procedure and dialysis are even longer in open surgery. Three or more large-size ports and additional instruments are needed for laparoscopic surgery. Omental resection by laparoscopy is also more expensive. Renal failure patients frequently are poor risks for lengthy general anesthesia and they commonly have severe coexisting medical problems. Therefore, operative procedures to solve catheter obstruction due to omental wraps should, ideally, be short and simple, effective in resolving the problem, and permit early return to PD.[9,28,29]

Given the simplicity of the procedure, no need to general anesthesia or special equipment and early patient discharge, this procedure has significantly lower cost.

Although previous studies suggest laparoscopic methods for PD catheter repair,[4,8,26,30-32] some disadvantages such as high cost, long operating time, and risks associated with general anesthesia remain.

CONCLUSIONS

We believe that this new method can solve aforementioned problems as described for laparoscopic or conventional surgery, and is a suitable way for malfunctioning PD catheter salvage.

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