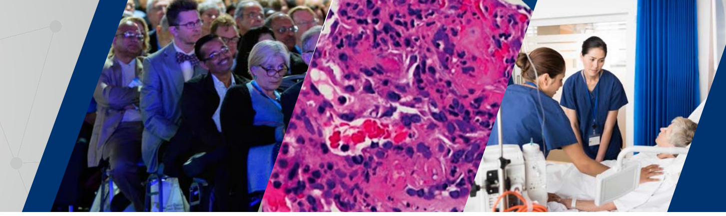
Kidney Case Conference: How I Treat



Management of the Poorly Draining Peritoneal Dialysis Catheter

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Introduction

A well-functioning peritoneal dialysis (PD) catheter is the key to successful therapy. It is required to deliver flow rates up to 350 ml/min when automated PD (APD) is used, whereas lower flows are sufficient for the gravity drain of manual continuous ambulatory PD (CAPD).[1] Catheter flow problems cause patient distress, disruption to treatment, additional cost for health care systems, and account for 14% of transfer to hemodialysis in the first 6 months of therapy.[2] PD catheters can be placed using a percutaneous Seldinger technique under local anesthetic, an open surgical minilaparotomy approach, or laparoscopically when additional procedures to increase likelihood of a successful outcome can be performed at the same time.[3]

Catheter flow problems range from minor disturbance to complete obstruction and affect up to 15% of patients depending on the insertion technique.[4] They generally result in a lower volume being drained from the peritoneal cavity than expected and are most commonly identified during patient training for PD or once APD is started—often highlighted by machine drain alarms. This review presents three cases to illustrate approaches to evaluate the underlying cause and devise management plans. These include clinical assessment and straightforward interventions, presented in case 1; more invasive interventions such as catheter repositioning or replacement, presented in case 2; or adjustment to the PD prescription where appropriate to do so, presented in case 3.

Case 1—Straightforward Interventions

A man in his fifties required dialysis secondary to chronic glomerulonephritis. A Tenckhoff catheter placed percutaneously worked well for several months, enabling him to use APD. However, after an intercurrent illness, his PD catheter flow became problematic and he developed multiple overnight alarms (Figure 1A). From the medical history, it was suspected that he was constipated, and he was treated with aperients. After effective bowel function, the catheter flow returned to normal (Figure 1B).

Discussion

The clinical history is important in the assessment of PD catheter dysfunction, supported by observation of a fill and drain. It is important to examine the catheter, its track through the anterior abdominal wall, and the genital area to exclude peritoneal leaks. Constipation is the most common cause of catheter dysfunction and is usually clear from the history. It can be confirmed by a plain abdominal radiograph and is straightforward to treat. Most patients on PD require regular aperients to maintain adequate bowel function, and it is important to use them in preparation for catheter insertion.

Investigation and directed interventions should start with the least invasive tests focusing on the most common causes.[5] If treatment for constipation does not improve catheter flow and the catheter tip is located correctly, the next step is to flush the catheter briskly with saline, which can then be followed by instillation with a fibrinolytic agent to clear possible intraluminal fibrin or clots.[5,6] Complete two-way obstruction is likely to be due to blockage with fibrin or thrombus; alternatively, kinking of the catheter may be the cause.

Case 2—Complex Interventions

A lady in her fifties started on APD using 2-L cycles, which functioned well for several months before developing a reduction in ultrafiltration (UF) in conjunction with recurrent overnight alarms due to low drain volume. A plain abdominal film demonstrated that the catheter tip had migrated out of the pelvis. She was keen to continue on APD and therefore underwent laparoscopic evaluation that demonstrated the presence of adherent omentum blocking the pelvic inlet, which was mobilized and fixed to the left hypochondrium. A new coiled peritoneal catheter was placed through a left paramedian incision with rectus sheath tunneling. After the procedure, she returned to APD, initially with 1-L cycles, before returning to her normal prescription.

Discussion

Catheter tip migration from the pelvis to a position where the drainage is poor or adherence of

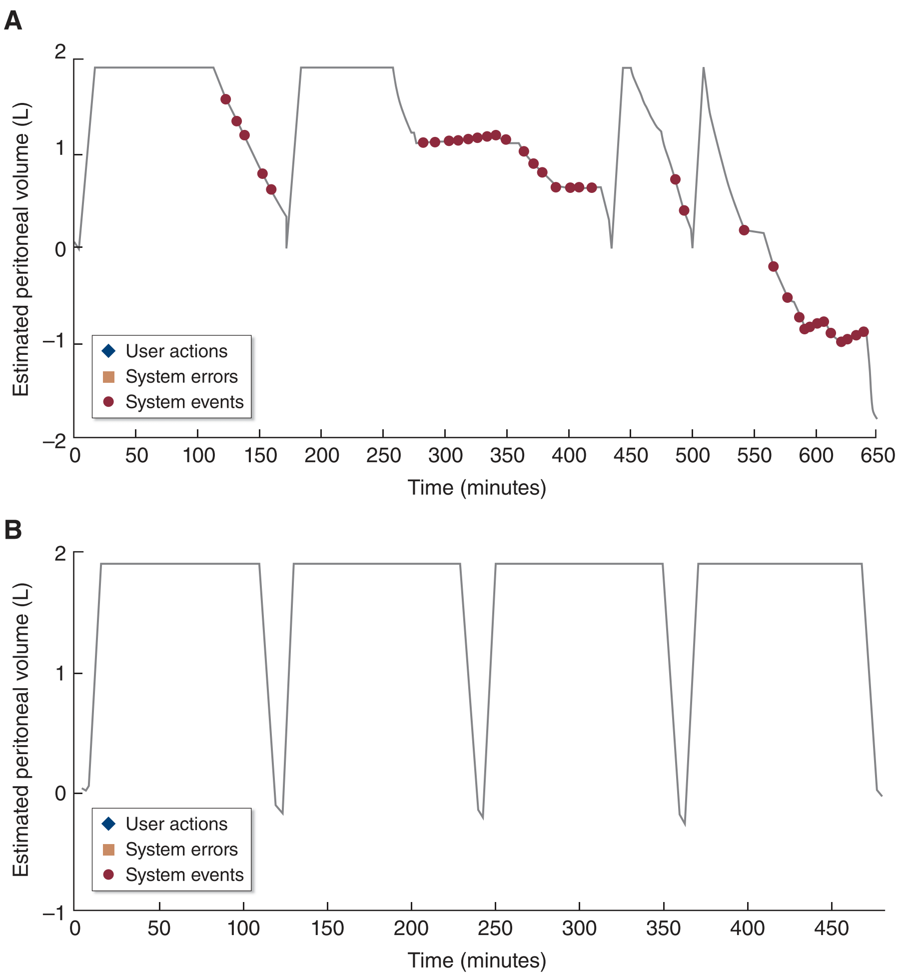

Figure 1. Peritoneal dialysis catheter flow profiles taken from remote patient monitoring (from Claria Sharesource; Baxter Healthcare Corporation, Deerfield, IL, with permission). (A) Impaired catheter drainage as demonstrated by the shape of the curves and the highlighted system errors. (B) This has resolved completely after treatment of constipation.

intraperitoneal tissues to the drainage holes causing obstruction are important causes of catheter flow dysfunction. Rarer causes include intraperitoneal adhesions, obstruction with ovarian fimbriae, or a distended bladder. It is important to exclude a leak of dialysate from the peritoneal cavity because this can also result in reduced effluent drainage. These can be into the scrotal or labial area, the anterior abdominal wall, the chest as a pleural effusion, or a retroperitoneal location.

Plain radiography—which should optimally be performed in two planes—confirms the location of the catheter tip. If the catheter tip has migrated out of the pelvis, interventional radiologic repositioning can be attempted.[7] The laparoscopic technique can be used to confirm the location of the catheter, reposition it, as well as identify and manage limiting components, such as omental wrapping around the catheter or adhesions as in case 2.[8] Alternatively, catheter replacement can be performed using the percutaneous, open surgical, or laparoscopic method. PD can be safely commenced postprocedure without the requirement for transfer to hemodialysis, using low dialysate volumes supine for the first 2 weeks postprocedure to reduce the risk of a postoperative leak.[5]

Case 3—Dialysis Prescription Adjustment

A man in his eighties with progressive CKD secondary to diabetes had a percutaneous PD catheter placed. After 3 weeks, he trained to commence APD but experienced recurrent alarms occurring toward the end of each drain that did not resolve after attention to bowel function or adjustment to a 70% tidal prescription. A plain abdominal film demonstrated that the PD catheter tip had migrated out of the pelvis and was projected over the left iliac crest. He did not want to undergo a catheter repositioning procedure. Catheter flow was, however, sufficient for him to perform manual CAPD using four exchanges per day, which, in conjunction with his residual kidney function (RKF), controlled electrolytes and volume adequately.

Discussion

When planning management, the severity of the catheter flow problem is a key consideration as well as the level of RKF and whether APD is required for reasons of lifestyle or treatment dose. Generally, patients who start PD as their primary dialysis therapy in a planned way have a degree of RKF, which makes management easier, with less requirements to deliver higher dialysate flows as demanded by APD. For this reason, some services routinely start all patients on CAPD requiring lower catheter flows, before moving to APD later, once there is confidence that the catheter is flowing well. It can at times be challenging to differentiate catheter flow problems from low UF, for example, in the presence of high small solute transport. It is also necessary to be cognizant of the residual volume of up to 200 ml that remains within the pelvis and more relevant when smaller fill volumes are used.

For patients on APD, it is helpful to review the fill and drain curves, which can be presented using remote patient monitoring where available (Figure 1, RPM, Claria Sharesource; Baxter Healthcare Corporation, Deerfield, IL). It is relevant to examine the timing and nature of alarms (*e.g.*, highlighting a low drain or reduced UF) and the impact of the flow impairment on the ability to deliver the treatment.[9] If the alarms occur toward the end of the drain, then a tidal prescription might be helpful—setting the tidal percentage above the drainage point where the alarms occur. It is important to be mindful of possible adverse consequences of tidal PD, which include reducing the effectiveness of the prescription and the potential risks associated with increased intraperitoneal pressure.[10]

Evaluation of PD catheter dysfunction requires a systematic approach starting with clinical assessment followed by graded investigations to assess the cause and determine the preferred course of action. Relatively simple interventions should be undertaken, including appropriate adjustments to the therapy prescription, before moving to more invasive interventions as required.

Disclosures

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Author Contributions

Conceptualization: Martin Wilkie.
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