

Who Shouldn't Get a Percutaneous PD Catheter?

Improving clinical outcomes with optimal patient selection and percutaneous techniques for peritoneal dialysis.

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Peritoneal dialysis (PD) use in the United States is increasing. Industry data show that between the years 2009 and 2013, the percentage of patients treated with PD among leading end-stage renal disease (ESRD) networks grew by as much as 68%.¹ This is a marked departure from the recent historical trend: between the years 1985 and 2000, the percentage of ESRD patients treated with PD in the United States had decreased from 15.8% to a low of 8.1%.² Much of the recent turnaround in PD can be attributed to the Medicare Improvement for Patients and Providers Act of 2011, also known as the “dialysis bundle.” The bundle not only changed the way Medicare reimburses providers for ESRD services, but also included both direct and indirect incentives favoring the use of PD over hemodialysis (HD).³

Another driver may be the increasing popularity of urgent-start PD.⁴ Urgent start is the rapid initiation of PD in late-presenting ESRD patients without a planned arteriovenous (AV) access. The advantages of urgent-start PD include the avoidance of hemodialysis catheters and improved compliance with quality outcome measures. Urgent-start PD programs require specific institutional infrastructure elements including clinical protocols, PD-specific nursing support, and the availability of PD-related supplies such as automated cyclers.⁵ Prompt placement of a PD catheter is required in order to initiate dialysis as soon as possible. Beginning dialysate exchanges immediately after PD catheter placement instead of waiting the customary 2 weeks for cuff ingrowth necessitates treatment modifications such as

recumbent bed rest and lower initial fluid volumes to prevent leaks.

Finally, there are several clinical advantages of PD over HD including decreased erythropoietin usage, better protection of residual renal function, and improved quality of life.⁶ The relationship of dialysis modality to survival is controversial, but some studies suggest a survival advantage with PD over HD during the first few years of treatment.^{6,7}

CATHETER PLACEMENT OPTIONS

Options for PD catheter placement include traditional open surgical techniques, laparoscopic implantation, and percutaneous insertion. Historically, most PD catheters have been placed by surgeons.⁸ Among surgical modalities, there is no conclusive evidence favoring one technique over another.⁹ The potential advantages of laparoscopic implantation over open surgery include smaller incisions, quicker recovery, and opportunities for performing ancillary procedures in the same setting (eg, omentopexy).¹⁰ The disadvantages of laparoscopic placement include increased cost and the need for specialized surgical expertise. Both laparoscopy and open surgery typically require the use of general anesthesia.

As the demand for PD services has increased, some ESRD providers have found that percutaneous PD catheter placement by interventional teams can minimize the delays often associated with surgical consultation and operating room scheduling.^{11,12} Because hospital interventional services are often readily available, percutaneous placement may also be the preferred technique for

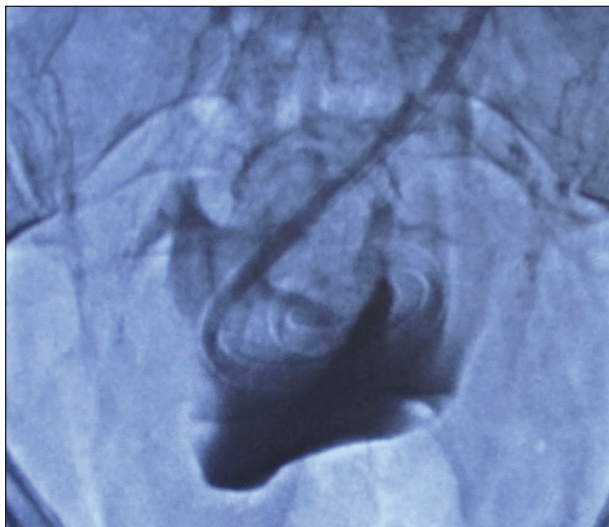


Figure 1. Fluoroscopic image of the pelvis after placement of a PD catheter with an injection of water-soluble contrast into the pelvic cul-de-sac.

urgent-start programs.¹³ Studies comparing outcomes of modern percutaneous catheter placement and surgical implantation have generally shown equivalence.¹⁴⁻¹⁶ The potential advantages of percutaneous PD catheter placement include decreased invasiveness, lower cost, and the avoidance of general anesthesia.¹³

Percutaneous PD Catheter Placement

Techniques have evolved since the initial experiences placing percutaneous fluoroscopic PD catheters were first reported.^{17,18} Variability among operators exists, but a general consensus regarding best practices for percutaneous PD catheter placement has been developed.¹³ A step-by-step guide to the placement of PD catheters is beyond the scope of this article, but interventionists who are experienced at placing tunneled central venous access devices and palliative peritoneal catheters will be familiar with the techniques and equipment used. In lieu of laparoscopic, peritoneoscopic, or open surgical visualization of the peritoneal cavity, interventionists use ultrasound, fluoroscopy, and an injection of iodinated contrast for guidance. As with other common interventional procedures, angiographic catheters, guidewires, pull-apart sheaths, needles, dilators, and tunnelers are used.

However, despite a technical similarity to other interventional procedures, an appreciation for the functional requirements of PD is critical to understanding proper catheter placement. A key observation is that efficient solute clearance and ultrafiltration require near-complete drainage of indwelling dialysate with each fluid

exchange. To achieve adequate drainage, the catheter coil must be positioned in the most dependent region of the peritoneal space: the posterior low pelvis. Meticulous attention to the location of the peritoneal access site, creation of an inferiorly angled tunnel through the rectus abdominis muscle, and fluoroscopic over-the-wire guidance are necessary to establish a stable position of the catheter coil within the pelvic cul-de-sac (Figure 1). Interventionists who are unfamiliar with PD but are eager to place PD catheters should access the available print and video resources and seek out training from experienced colleagues.

Attention to the nontechnical clinical details of catheter placement is equally important to the successful initiation of PD. Patient education, including communication of clear verbal and written instructions, is necessary to ensure proper healing and prevent infection. After placement, a sturdy, breathable dressing must completely cover the abdominal incision and catheter. The dressing must not be removed by the patient or allowed to become wet. Follow-up visits with the PD nurse for training, catheter flushes, and bandage changes are mandatory. Unless the catheter is used immediately as part of an urgent-start program, a minimum 2-week healing time is needed to ensure tissue ingrowth of the catheter cuffs and prevent fluid leaks prior to starting PD.

PATIENT SELECTION

Interventionists placing PD catheters should not only use best clinical and procedural practices, but should also participate with the provider team in selecting appropriate patients for catheter placement. Before an elective catheter placement, the patient should be seen in the clinic and a careful history and physical exam obtained. Factors that could interfere with successful PD should be actively sought out and, when possible, corrected. A careful surgical history should be taken. The review of systems should include questions regarding bowel habits and hygiene. Initial planning for the catheter position should be performed with the patient supine and upright to avoid locating the exit site within a skin fold or at the belt line.

It is important to recognize that patients lacking mental or physical capabilities adequate to the demands of home therapy are sometimes referred for evaluation. Psychosocial issues including indifference, domestic turmoil, intermittent homelessness, and financial distress are risk factors for technique failure. As part of the PD team, the interventionist should help to identify these issues and recommend another treatment modality, when appropriate.

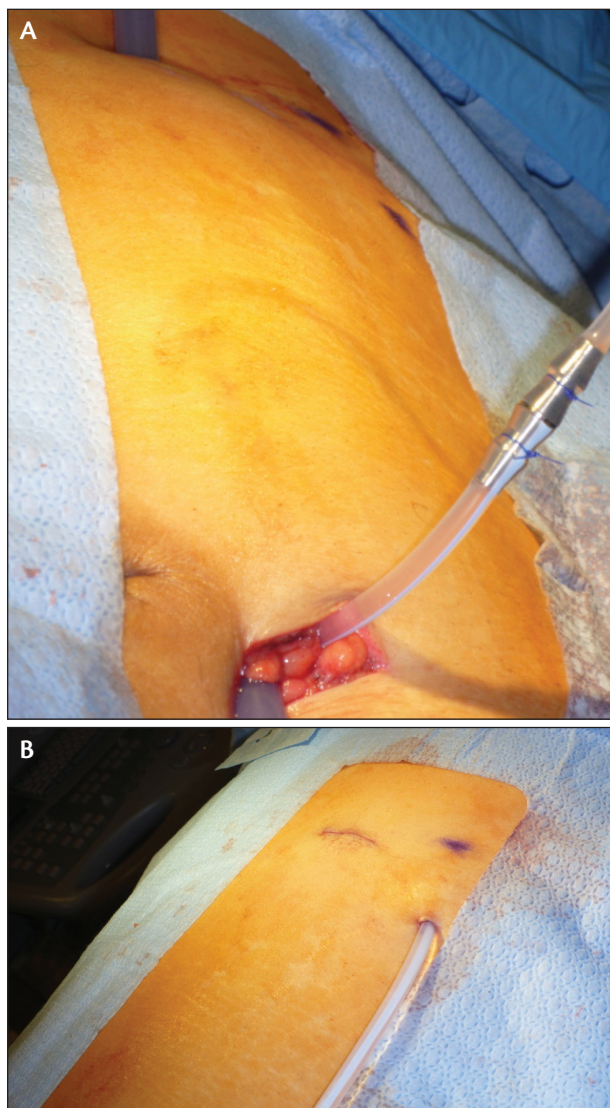


Figure 2. Creation of an upper abdominal exit site in an obese patient. The blue tunneler has been passed from the access incision at the bottom of the image to the epigastric incision at the top of the image (A). The completed upper abdominal exit site (B).

Contraindications to Peritoneal Dialysis

All members of the treatment team should be familiar with the contraindications to PD. Absolute and relative contraindications to peritoneal dialysis are well established and are listed in the Contraindications to PD sidebar.¹⁹

Miscellaneous Conditions

Beyond the established contraindications, there are a variety of conditions that can result in unsuccessful PD or an increased risk of complications. Interventionists

CONTRAINDICATIONS TO PD

Absolute Contraindications to PD

- Documented loss of peritoneal function
- Extensive abdominal adhesions that limit dialysate flow
- In the absence of a suitable assistant, a patient who is physically or mentally incapable of performing PD
- Uncorrectable hernias or body wall defects

Relative Contraindications to PD

- Fresh intra-abdominal foreign bodies
- Peritoneal leaks
- Body size limitations
- Intolerance to PD volumes
- Inflammatory or ischemic bowel disease
- Abdominal wall or skin infection
- Morbid obesity (in short individuals)
- Severe malnutrition
- Frequent episodes of diverticulitis

Derived from the National Kidney Foundation KDOQI Clinical Practice Guidelines for Peritoneal Dialysis Adequacy Update 2000; Guideline 30 and 31.¹⁹

must be prepared to grapple with the appropriateness and consequences of treating patients who are less than ideal candidates for catheter placement.

The presence of obesity creates challenges to the success of both HD and PD. Obese patients undergoing PD are at increased risk of catheter leak, exit site infection, and peritonitis compared with nonobese patients.^{19,20} A high body mass index can result in inadequate solute clearance and ultrafiltration, resulting in the need for larger dwell volumes. Nevertheless, obesity alone as a contraindication to PD is controversial, and in our experience, PD usage has been successfully extended to include an increasing number of patients with a body mass index > 40. With adjustments for soft tissue thickness and mobility, catheters can be successfully placed into most patients who are moderately obese. In the morbidly obese patient, an extended catheter with a high abdominal or presternal exit site can be used to avoid placement in a skin fold or the pannus region, but percutaneous placement of an extended catheter should not be attempted without considerable operator experience (Figure 2).

Previous abdominal surgeries (eg, cholecystectomy, appendectomy, hysterectomy, and renal transplant) are common in patients presenting for PD catheter placement. A history of multiple prior abdominal surgeries and physical exam findings showing multiple abdominal incisions does not preclude percutaneous PD catheter

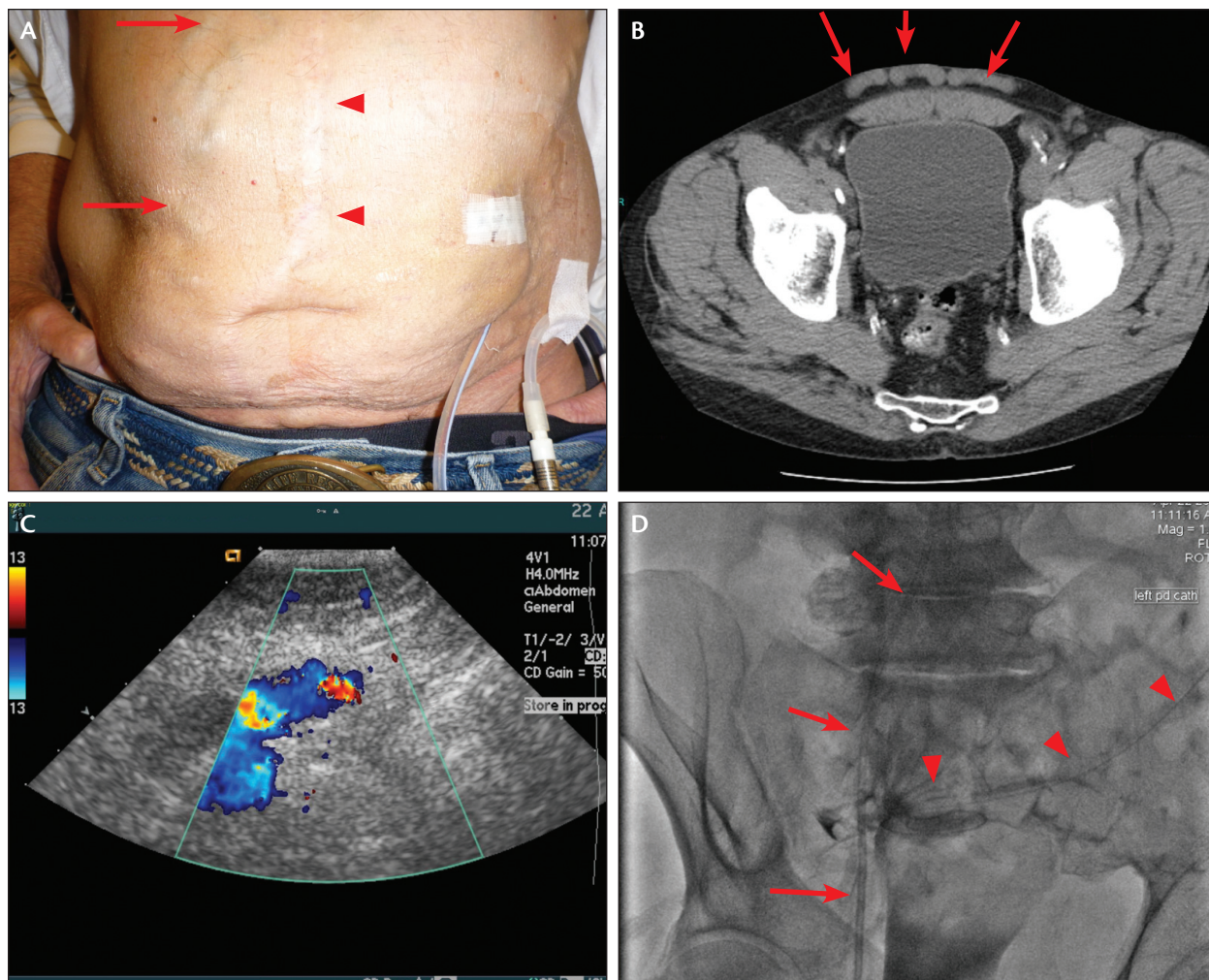


Figure 3. A PD catheter in a patient with short-gut syndrome and limited venous access. Multiple central venous catheters and chronic total parenteral nutrition have resulted in chronic superior vena cava occlusion and multiple large abdominal collateral veins (arrows). There have been multiple previous abdominal surgeries (arrowheads indicate a midline scar; A). CT image showing large collateral veins in the anterior abdomen (arrows; B). Ultrasound guidance was used to avoid injury to enlarged veins during catheter placement. Ultrasound image obtained during catheter placement shows a large vein perforating the rectus abdominis muscle (C). Right anterior oblique fluoroscopic image after catheter placement and contrast injection (arrowheads; D). A right femoral Hickman catheter used for total parenteral nutrition (arrows; D).

placement unless there is a history of extensive adhesions. Scattered adhesions can often be circumnavigated under fluoroscopy using a hydrophilic guidewire and an angiographic catheter to facilitate access into the pelvis. Catheter placement in a postsurgical “frozen abdomen” should not be attempted.

PD may sometimes be the only available treatment modality for patients with limited or exhausted venous access. In the presence of chronic central venous obstruction, large body wall venous collaterals can develop. Catheter placement in patients with enlarged collateral veins may result in acute bleeding complications, but

careful imaging guidance can be used to avoid vascular injury (Figure 3B through D).

Despite the intra-abdominal mass effect produced by enlarged kidneys in the setting of autosomal dominant polycystic kidney disease (ADPKD), PD can be successfully used in many patients.^{21,22} ADPKD is associated with hernias and colonic diverticula, but there is no evidence that patients on PD are at increased risk of peritonitis.^{22,23} Patients with ADPKD should be questioned about the presence of bulk symptoms including abdominal fullness, early satiety, and constipation. If symptoms are present, noncontrast abdominal CT imaging can be

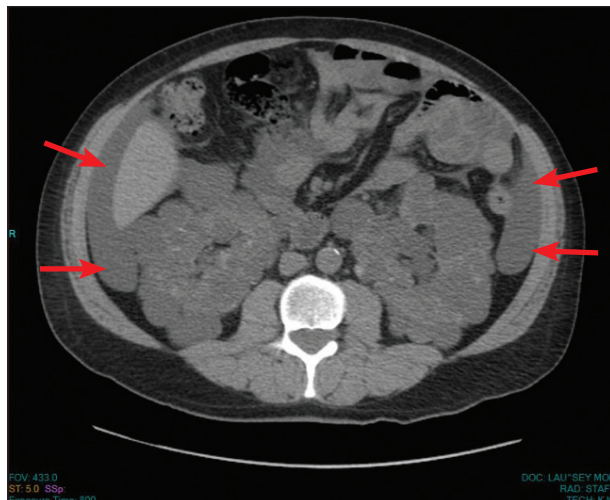


Figure 4. A noncontrast CT image demonstrating enlarged cystic kidneys in a patient with ADPKD. Renal enlargement is moderate, and the patient has no bulk symptoms. A PD catheter placed 4 years before is still in use (not shown). Dialysate in the paracolic gutters (arrows).

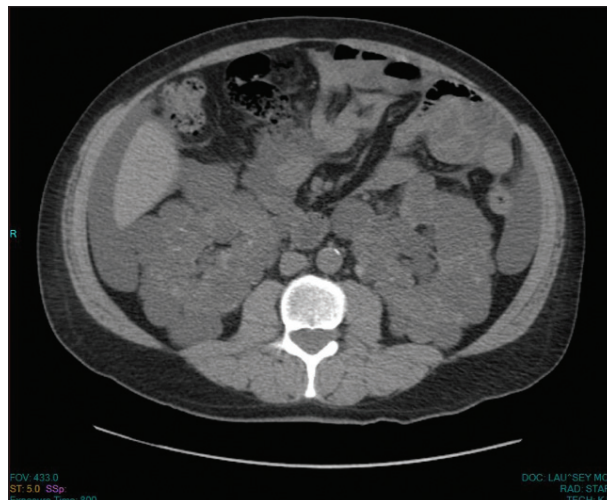


Figure 5. Noncontrast CT in a patient with ADPKD and complaints of constipation and early satiety. Massive renal enlargement limits the available peritoneal volume and produces bulk symptoms. PD catheter placement was not recommended.



Figure 6. A PD catheter in a patient with scleroderma. AV access is contraindicated because of cutaneous fibrosis, but peritoneal membrane function is preserved.

helpful to estimate the available residual peritoneal volume (Figures 4 and 5).

Patients with chronic constipation and other causes of abnormal colonic distention may be unsuitable candidates. PD has been successfully implemented in patients with a colostomy or ileostomy, but with an increased risk of infection.¹⁹ If alternatives to PD are limited in a patient with a colostomy, patient education regarding meticulous hand washing and cleanliness are necessary prior to

placing a PD catheter. The catheter should be placed on the side opposite the colostomy.

Autoimmune diseases such as rheumatoid arthritis and lupus erythematosus are also associated with an increased risk of infection, and therefore, hemodialysis is usually the technique of choice in these patients.²⁴ There are few reports describing peritoneal dialysis in patients with collagen vascular diseases, but despite the cutaneous fibrosis that can preclude placement of an AV access in patients with scleroderma, membrane function is often preserved (Figure 6).^{25,26}

Patients with cirrhosis and ascites are at an increased risk of spontaneous bacterial peritonitis and protein loss, but successful PD in those with cirrhosis-related ascites has been described. There are no clinical studies directly comparing outcomes of HD with PD in this patient population, but available studies suggest that the risk of PD-related complications is not significantly different from noncirrhotic patients.²⁷

CONCLUSION

PD provides better quality of life and may confer a survival advantage compared with HD.^{6,28} Percutaneous fluoroscopic-guided PD catheter placement is a viable alternative to surgical implantation and may be ideally suited for initiation of dialysis as part of an urgent-start program. Interventionists placing PD catheters must not only strive for optimal outcomes by using best practices, but must also be prepared to actively participate with the provider team in choosing appropriate candidates for PD. ■

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