

# Peritoneal Dialysis in ESRD Patients

Case planning and techniques for this cost-effective method of renal replacement therapy.

BY DENNIS FRY, MD

The incidence of end-stage renal disease (ESRD) is increasing at an alarming rate. In 2009, there were 116,395 patients with a new diagnosis of ESRD, and the combined incidence of ESRD as a primary diagnosis between 2006 and 2010 was 558,639 patients, as reported in the United States Renal Data System 2011 annual report.<sup>1</sup> It is estimated that by the year 2030, the number of patients in the United States with ESRD will reach as high as 2.24 million. Options for these patients will include hemodialysis (HD), peritoneal dialysis (PD), and renal transplant. The average costs of these modalities are as follows: \$82,285 per year for HD, \$61,588 per year for PD, and \$29,983 per year for transplant (in 2009 dollars).<sup>1</sup> The financial benefits of PD are obvious, and combined with increased patient autonomy, we will soon see a greater need for physicians who are skilled in PD catheter placement.

## BACKGROUND

Georg Ganter performed the first successful use of PD in a patient with renal failure after childbirth in Germany in 1923. The treatment was successful, and the patient left the hospital after her labs had corrected, only to die shortly after discharge due to the fact that dialysis was not repeated. In the post-World

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War II days, PD solutions were further improved, as were the sterilization processes. It was not until the 1960s, however, that W. E. Quinton, MD, developed the first silicone catheters, which improved the instillation and exchange of dialysis solutions. The Quinton catheter was then improved when H. Tenckhoff, MD, placed Dacron cuffs on the catheter. These Dacron cuffs helped to prevent pericatheter leaks and infections, thus increasing the lifetime of the catheter. In 1975, PD was revolutionized by the technique of using continuous ambulatory PD. This allowed patients to live more active lives, and PD started to gain popularity.

## POTENTIAL BENEFITS OF PD

In terms of outcomes, PD and HD are essentially equal for renal replacement therapy during the first 5 years after the onset of renal failure. Data support improved survival with PD during the first 2 to 3 years

due to better preservation of residual kidney function. There is also a lower incidence of hepatitis C and of delayed kidney function after transplant. Most important for the patient is that there are fewer dietary restrictions and an improved quality of life due to more independence from the dialysis centers. PD also allows for preservation of access sites, and if there are no suitable HD sites left, it provides an option for continued dialysis. Finally, there is the financial benefit of PD over HD. When comparing the cost analysis for dialysis treatments, there was a \$21,000 savings benefit for PD over HD in 2009.

### PROCEDURAL PLANNING

Infection is the number one cause for loss of PD to HD; the second most common is mechanical catheter failure. PD catheter failures can be caused by catheter migration, tissue engulfment (omental wrap or bowel mesenteric entrapment of the catheter), pericatheter leaks, hernias, and cuff extrusion. With proper perioperative planning, the mechanical—and even some of the infectious—causes of loss can be reduced.

Preoperatively, patients need to be evaluated in the standing, sitting, and laying position while disrobed. This allows the physician to see where it is best to place the external (distal) portion of the PD catheter. The belt lines and skin folds should be avoided when planning the exit site. Catheters that are placed on a belt line are often irritated by friction of the belt or pant line. Catheters that are placed in skin folds are susceptible to infection because they are not easily cleaned and are more difficult to keep properly dressed. Once the location of the catheter exit site is determined, it should be marked in indelible ink to be easily found on the day of the operation.

### LAPAROSCOPIC PLACEMENT OF A PD CATHETER

Both open and laparoscopic techniques are used for the placement of PD catheters. The laparoscopic technique, however, is the only reliable way to evaluate the abdomen for its suitability in achieving successful PD catheter function. This technique allows for the evaluation of the peritoneum for adhesions that may compartmentalize the abdomen and to see if the omentum extends to the pelvis, which can cause omental wrap, even in a well-placed PD catheter. The laparoscope also allows the surgeon to look for hernias that may have been missed on the physical exam.

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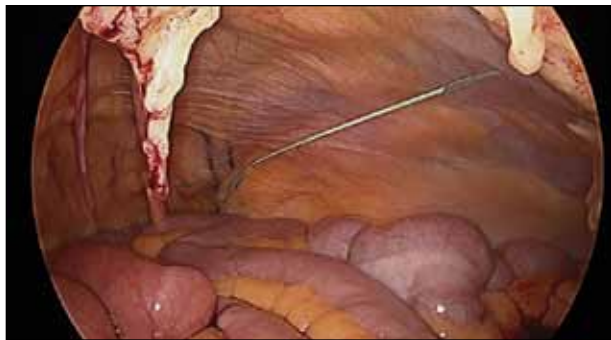


**Figure 1.** Maintaining a shallow angle when placing a sheath to keep the needle in the rectus sheath for the length of the access needle.

ally arises due to the perceived low complexity of this procedure and subsequent lack of attention to detail when placing the PD catheter. In the following paragraphs, I will describe the technique I use for insertion of PD catheters. This technique is not only time efficient but also functionally effective.

With the patient anesthetized, I make a paramedian incision, typically in the left upper quadrant. Then using S-retractors, I bluntly dissect down to the anterior rectus fascia, opening the anterior rectus sheath with a scalpel. I then bluntly separate the rectus muscle fibers to identify the posterior rectus sheath. I open the posterior rectus sheath and the peritoneum with scissors and place a 10-mm Blunt Tip trocar device (Covidien, Mansfield, MA). The abdomen is then insufflated, and the laparoscope is inserted. This is the point in the procedure when I perform a general evaluation of the abdominal cavity and look for adhesions and hernias. If a hernia is found, I will generally fix it when I place the PD catheter.

With the laparoscopic evaluation complete, I then use a 19-gauge, 7-cm percutaneous entry thin wall



**Figure 2.** A stiff wire guide entering the abdomen through needle access.



**Figure 3.** A Peel-Away sheath in the abdomen under the rectus muscle.

access needle (Cook Medical, Bloomington, IN) to enter into the abdomen on the opposite side of the laparoscopic port site. I usually enter 4 to 5 cm cephalad to the umbilicus and lateral to the rectus sheath, aiming slightly medially with a very shallow angle (Figure 1). This angle will keep the needle in the rectus sheath for the length of the access needle (typically 5–6 cm) before entering the abdominal cavity. The length and angle of this rectus tunnel helps ensure that the PD catheter heals in place and, more importantly, maintains a constant downward angle to keep the pigtail portion of the catheter in the pelvic location.

With the needle in place, I insert an Amplatz Extra-Stiff wire guide (Cook Medical) (Figure 2). Then, over the wire, I will insert a 20-F Peel-Away introducer (Cook Medical) into the abdominal cavity (Figure 3). With the sheath in place, I remove the wire and inner dilator, squeezing the sheath so not to lose the pneumoperitoneum. I then insert a 62-mm Argyle curl cath PD catheter (Covidien) with two cuffs, which has been soaked in saline and loaded onto a 2- X 900-mm Ball-Tipped guide rod (Smith & Nephew, Memphis, TN) down the Peel-Away sheath.

The PD catheter needs to be soaked in saline to ensure that there is no air in the Dacron cuffs and to make it slide more easily down the Peel-Away sheath. The catheter is advanced down the Peel-Away sheath to position the most proximal cuff just outside of the peritoneum (not in the abdominal cavity), then peel

the sheath away, and the second cuff will be seen just outside of the incision used for the initial insertion of the Peel-Away sheath. I use an Argyle PD faller tunneling trocar (Covidien) to bring the distal portion of the PD catheter out of the skin in my predetermined position. I make sure that this subcutaneous tunnel is arching in a slightly downward-sloping position to help with the draining portion of dialysis.

With the catheter in place, I close the posterior rectus sheath and peritoneum with a 0 Vicryl suture (Ethicon, Inc., Somerville, NJ), followed by the anterior rectus sheath with 0 Vicryl suture, and finally, the skin with a 4-0 Vicryl suture. Before completing the procedure, the catheter is tested by instilling at least 200 mL of fluid into the abdomen and then allowing it to drain out to ensure that there will be good exchange. The majority of these patients are discharged within 2 hours of this procedure.

## CONCLUSION

PD is a cost-effective form of renal replacement therapy that provides patients with maximum autonomy. PD catheters should exit the body in a location that is easy for the patient to see and should not be placed on the belt line or in skin folds. PD catheters need to be viewed as the initial access site in order to preserve venous access for future use. Finally, every effort should be made from preoperative planning to proper surgical implantation to ensure a well-functioning catheter on the first attempt. ■

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## TAKE-HOME POINTS

- It is important to use a laparoscope for PD.
- Be sure to tunnel the catheter in the rectus muscle for at least 4 to 6 cm.
- Fix hernias when they are encountered.

1. The United States Renal Data System. USRDS 2011 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States, National Institutes of Health, National Institute of Diabetes, and Digestive and Kidney Diseases. <http://www.usrds.org/atlas.aspx>. Published November 22, 2011.