DAN O’ROURKE, 43, was admitted to your telemetry unit today from the emergency department with a diagnosis of arrhythmia-induced syncope. When you assess him at the beginning of the evening shift, he tells you he has a catheter for peritoneal dialysis (PD) and he’ll need overnight exchanges. He’s been doing his own dialysis exchanges since he developed rhabdomyolysis-induced acute tubular necrosis and end-stage renal disease (ESRD) about a year ago, after a serious electrical burn injury. If you don’t perform PD regularly and no clinical educator is available to help, how confident would you be?

Although PD is considered a simpler form of dialysis than hemodialysis, it can cause serious complications if not performed correctly. In this article, I’ll review proper technique for PD exchange, your responsibilities, and common PD problems.

Comparing PD and hemodialysis
Peritoneal dialysis and hemodialysis can be either temporary or permanent treatments for acute or chronic renal failure. Hemodialysis uses an extracorporeal circuit to remove toxins and wastes. Disadvantages of this method include complications related to the extracorporeal circuit (such as thrombus formation) and cardiovascular changes (such as hypotension and arrhythmias) that occur during the procedure.

Peritoneal dialysis uses the peritoneal membrane as a filter. Compared with hemodialysis, it’s slower, requires less equipment, and causes fewer physiologic adverse reactions (more on this later). Unlike hemodialysis, PD can be performed by specially prepared medical/surgical nurses or by the patient. Peritoneal dialysis (PD) can be used instead of hemodialysis for patients with acute renal failure, chronic renal failure, chemical poisoning, acidosis, hypervolemia, and end-stage renal disease awaiting renal transplantation. Contraindications to PD include documented loss of peritoneal function or extensive abdominal adhesions that would limit dialysate flow, frequent peritonitis, uncorrectable mechanical defects (such as an irreparable hernia) that would prevent PD from being effective or increase the risk of infection, and the lack of assistance for a patient who’s physically or mentally unable to perform PD.

How does PD work?
Used as a filter in PD, the peritoneum is a semipermeable membrane that allows fluid and electrolyte exchange between the bloodstream and the dialysate in the peritoneal cavity. One cycle of dialysate inflow, dwell, and outflow (or drain)—called a PD exchange—typically lasts 30 to 90 minutes.

The PD system consists of an indwelling peritoneal catheter, dialysate, and the administration transfer set (see Understanding the PD Setup). In most cases, the physician inserts a Tenckhoff catheter surgically during a laparotomy or laparoscopically. Providing access to the peritoneal cavity, the catheter is the route for infusing dialysate and removing metabolic wastes and fluid. Fibrous tissue attaches to the catheter’s polyester fabric cuffs, anchoring the catheter subcutaneously and sealing the peritoneal cavity from bacteria tracking in from the skin and from dialysate leakage.

Although PD catheters can be used immediately after insertion, a 10- to 14-day waiting period is recommended to promote healing and decrease the chance of dialysate leaks. During this time, monitor the patient for surgical complications such as peritonitis and bowel or bladder perforation.

The dialysate, similar in composition to normal plasma, is made hypertonic by dextrose. The higher the dextrose concentration, the greater the osmotic effect and the more water removed from the patient’s bloodstream. Dialysate is available in three concentrations: 1.5%, 2.5%, and 4.25%. (For more details, see How Types of Peritoneal Dialysis Compare.)

Solutions are removed by diffusion—moving from the bloodstream (an area of high concentration)
through the peritoneum to the dialysate (an area of low concentration). The rate of solute removal can be influenced by drugs, infection, patient position, and exercise.

The administration transfer set is the intravenous (I.V.)-type tubing connecting the dialysate bag and PD catheter. The set can be disconnected between exchanges, and an infusion clamp is used to control the flow rate during inflow. (If the patient complains of cramping or nausea, use a slower fill rate.) Follow strict aseptic technique when connecting the PD catheter to the administration transfer set.

Your role during PD
To prevent problems, monitor the patient closely before, during, and after an exchange and record his vital signs according to your facility’s policy. Your priorities include obtaining daily weights, maintaining strict aseptic technique, recording intake and output accurately, monitoring the patient’s serum glucose levels, and monitoring fluid loss and retention.

Know the patient’s serum electrolyte levels before the exchange. Potassium and other electrolytes can be pulled out of the bloodstream by the dialysate solution. If the patient is hypokalemic, the prescriber can have potassium added to the dialysate.

Proper hand hygiene is crucial to prevent infection. Use strict aseptic technique: You and your patient should be wearing surgical masks anytime the PD system is opened. You should also wear sterile gloves when changing the PD catheter dressing, manipulating the PD catheter, or performing exit site care.

You must carefully monitor intake and output during exchanges to assess for any outflow problems. Before spiking the dialysate bag, measure the total volume. The outflow amount should be greater than the inflow amount.

In some hospitals, a no-touch device (also called a connection device) is used to spike the dialysate bag. An infusion clamp may be placed at the infusion port to keep dialysate from leaking into the connection device. In other hospitals, the dialysate is spiked in the same way as other I.V. infusions.

Next, prime the tubing and expel all air. Then, connect the tubing to the PD catheter using aseptic technique. Wrap two fresh povidone-iodine 4x4 sterile gauze dressings around the tubing and catheter junction and let the antiseptic soak in for 5 minutes.

After the tubing is set and connected to the catheter, the exchange can begin. Open the infusion clamp. (If the setup has a second bag for outflow, make sure the clamp to the outflow bag is closed.) Gravity infusion time into the peritoneal cavity can range from 10 to 15 minutes.

How types of peritoneal dialysis compare
According to the National Institute of Diabetes and Digestive and Kidney Diseases, the three types of peritoneal dialysis differ mainly in their exchange schedules.

Continuous ambulatory peritoneal dialysis
The most common of the three types, this is easy for most patients to learn. It consists of four exchanges per day of 2 liters of dialysate each time. Dwell time can range from 4 to 10 hours. No machine is needed; gravity is used to fill and empty the abdomen.

Nocturnal intermittent peritoneal dialysis
The patient is dialyzed three to five times per week for 10 to 12 hours each time. The peritoneum is left empty between exchanges.

Continuous cycling peritoneal dialysis
A combination of intermittent and continuous ambulatory peritoneal dialysis, this is considered a home treatment and used at night. A cycler machine performs about three exchanges at night while the person sleeps. During the day, the patient performs one exchange with a dwell time that lasts the entire day.
Once all the solution has infused, close all fill line clamps to prevent air from entering the peritoneal cavity. The dialysate stays in the patient's body for 20 to 30 minutes during intermittent PD, or up to several hours for those on continuous ambulatory PD.

To begin the drain, hang the empty dialysis bag over the side of the bed and open the drain line clamps. Assess the color and consistency of the drainage as it flows out over the next 10 to 15 minutes. Normal outflow should be pale yellow and free from clots and blood (although it will be blood-tinged if the PD catheter was recently placed). Frothiness associated with protein content is normal.

If the outflow looks cloudy or changes consistency, examine it carefully for fibrinous clots floating in the bag. Document these changes and the patient's fluid balance on the supplemental flow sheet designated for PD exchanges and notify the nephrologist.

If your records show that outflow amounts are decreasing and you've tried the usual interventions—such as increasing the distance between exit site and bag, elevating the head of the bed, or turning the patient from side to side—notify the patient's nephrologist about the possible outflow problem. He may prescribe intraperitoneal heparin, which should be added to the dialysate immediately before spiking the bag. If outflow problems persist, document them and notify the nephrologist.

Following your institution's policy, provide meticulous exit site care, inspecting for any symptoms of redness, irritation, or abnormal drainage. Check the patient for diffuse abdominal pain, rebound tenderness, and abdominal distension. A feeling of abdominal fullness is normal, abdominal pain isn't.

Clean the site with an antibacterial solution and cover it with an occlusive dressing. This helps prevent site infection and stabilizes the catheter.

Managing Mr. O'Rourke's condition

Now let's look at how you'd manage Mr. O'Rourke's condition. He'll need to be in a private room because of the risk of infection. Peritonitis is a common complication in patients with ESRD who are treated with PD. Patients with ESRD also have weakened immune systems, putting them at higher risk for peritonitis.

Unlike other types of peritonitis caused by endogenous bacteria, peritonitis associated with PD usually involves skin organisms. The main portal of entry for these organisms is through the PD catheter lumen or the exit site, which explains why meticulous PD technique and exit site care are so important. About 75% of PD-related peritonitis cases are caused by Gram-positive organisms, particularly *Staphylococcus aureus* and *Staphylococcus epidermidis*. Monitor your patient for systemic signs of infection such as fever, tachycardia, elevated white blood cell counts, and abdominal pain. In our institution, if peritonitis is suspected, we send one outflow bag to the lab for culture along with a specimen from the exit site. The patient may need antibiotics, and the catheter may be removed.

Because Mr. O'Rourke was diagnosed with arrhythmia-induced syncope, your cardiac assessment is a priority. Fluid shifts and electrolyte imbalances, which can cause arrhythmias, are common during dialysis and can be exacerbated when the patient also has signs of infection.

Make sure Mr. O'Rourke is seen by the nutritionist and maintains a protein-rich, fluid-restricted diet. He needs plenty of protein because large amounts are lost during each dialysis exchange. Fluids should be restricted to maintain extracellular fluid volume at a normal level. Monitoring weight, along with serum albumin and protein levels, is essential to prevent malnutrition.

Once you've reviewed the PD protocol and understand the plan of treatment ordered, talk with Mr. O'Rourke and his family. Acknowledge their experience with PD and answer any questions they may have. Mr. O'Rourke's atrial arrhythmia was secondary to acute fluid overload, and the more aggressive PD exchanges done in the hospital helped remove excess water. Teach him to report signs and symptoms of fluid overload (including sudden weight gain) to his primary care provider. He's discharged home, reports no problem with PD exchanges on follow-up, and returns to work in 10 days.