



Preventing Home Dialysis Complications

Teaching family caregivers to recognize and respond to vascular access hemorrhage and peritonitis.

This article is part of a series, *Supporting Family Caregivers: No Longer Home Alone*, published in collaboration with the AARP Public Policy Institute. Results of focus groups, conducted as part of the AARP Public Policy Institute's No Longer Home Alone video project, supported evidence that family caregivers aren't given the information they need to manage the complex care regimens of family members. This series of articles and accompanying videos aims to help nurses provide caregivers with the tools they need to manage their family member's health care at home. Nurses should read the articles first, so they understand how best to help family caregivers. Then they can refer caregivers to the informational tear sheet—*Information for Family Caregivers*—and instructional videos, encouraging them to ask questions. For additional information, see *Resources for Nurses*.

Managing home dialysis can be one of the most complex and challenging tasks family caregivers face. People who have end-stage renal disease (also referred to as end-stage kidney disease) are increasingly receiving hemodialysis or peritoneal dialysis at home. They and their caregivers must take care of the vascular access and manage serious potential complications, such as hemorrhage and peritonitis. In a national survey, family caregivers have noted their concerns about making mistakes and managing a loved one's pain and discomfort—worries that may be especially acute for caregivers of someone receiving dialysis at home.¹ When asked what would make it easier to perform complex tasks like home dialysis, the most common response from survey participants was more and better instruction.¹

The July 2019 Executive Order on Advancing American Kidney Health highlights the essential role of nurses in helping to prepare caregivers for managing home dialysis.² This order aims to reduce the risk of kidney failure, encourage the development of artificial kidney technology, and increase the use of home dialysis and kidney transplantation. In conjunction with this executive order, the U.S. Department of Health and Human Services released the Advancing American Kidney Health initiative, with the goal of ensuring that by 2025 80% of people newly diagnosed with end-stage renal disease receive either dialysis at home or a transplant.³ The most recent United States Renal Data System report shows that in December 2017,

nearly three-quarters of a million people had end-stage renal disease, of whom approximately 12% were receiving dialysis at home.⁴ To achieve the goals of the executive order and the Advancing American Kidney Health initiative, many more patients and family caregivers will need to be trained by nurses to perform hemodialysis and peritoneal dialysis at home.

Since the early 1970s, most dialysis treatment has been covered by Medicare. The Centers for Medicare and Medicaid Services (CMS) certifies dialysis facilities to provide training for home dialysis, mandating a comprehensive training program for patients and caregivers. This training, which is provided by a nurse, must address the operation of equipment, the administration of medication, infection control precautions, emergencies, complications, resources, documentation, and proper waste disposal.⁵ Despite this extensive training and the confidence many patients and caregivers feel when managing home dialysis treatment, they may also worry about responding appropriately when problems or emergencies arise. The CMS requires dialysis facilities to have call services available to home patients, 24 hours a day, seven days a week, for dialysis-related emergencies.⁶ It's essential that nurses teach patients and family caregivers to contact the on-call nurse when problems arise and, if emergent medical care is needed, 911. In their educational and instructional efforts, nurses should use the principles of adult learning, such as practice and repetition, to help ensure both patients and family



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The home nurse responds to a family caregiver's concerns before beginning at-home peritoneal dialysis. Photo courtesy of the AARP Public Policy Institute.

caregivers feel prepared for the challenges and responsibility of providing home dialysis treatment.

HEMODIALYSIS

Hemodialysis involves the use of an artificial kidney or dialyzer, which filters waste and excess fluid from the blood. Two needles are placed in the access, and a machine pumps the blood from one needle into the dialyzer, returning it to the body through the second needle. Some of the machines are more portable than others, and electrical and plumbing modifications to the patient's home may be necessary. According to the United States Renal Data System report, patients choose peritoneal dialysis, which typically allows for greater independence, more than five times as often as hemodialysis for home treatment^{4,7}; however, newer technology is making it easier for patients to set up, clean, and operate hemodialysis equipment at home.⁸

Conventional or traditional hemodialysis is performed three times a week, much like treatment at an outpatient dialysis clinic, but hemodialysis can also be performed with varied frequency. Treatment can occur every other day, for instance, which helps to avoid the two-day intradialytic period that has been associated with increased sudden death.⁹ It may also be performed four or more days a week, with a shorter length of treatment each day, which is commonly referred to as short daily dialysis.

The vascular access is frequently referred to as a lifeline for patients receiving hemodialysis at home. Three types of vascular access are used for hemodialysis.¹⁰ An arteriovenous fistula is a surgically created direct connection between an artery and a nearby vein, allowing the high-pressure, fast-moving arterial blood to flow into the low-pressure, slower-moving venous blood, causing engorgement, dilation, and wall thickening (see Figure 1). An arteriovenous graft is a surgically created connection between an artery and a vein using an implanted, usually synthetic material, such as polytetrafluoroethylene, to provide a permanent vascular access for hemodialysis (see Figure 2). Both arteriovenous fistulas and grafts are typically located in the forearm, but the upper arm, thigh, and, rarely, the chest may also be used. Based on current guidelines, an arteriovenous fistula is the first choice for hemodialysis vascular access, followed by arteriovenous graft.¹⁰ A central venous catheter is used infrequently for home hemodialysis; when used, the catheter is typically tunneled and has dual lumens and a Dacron cuff, into which tissue grows. It's placed into a high-flowing central vein or the right atrium.

Vascular access management. Care of the vascular access aims to prevent thrombosis, infection, and trauma. Nurses should ensure patients and caregivers know that the arm containing the access should not be used for blood pressure measurement,



Information for Family Caregivers

Home Hemodialysis

Vascular Access Dos and Don'ts

- Do wash your hands before touching the access.
- Do check for the thrill and bruit each day.
- Do prepare the skin prior to placing the needles, and rotate needle sites.
- Do report any signs and symptoms of infection immediately.
- Do avoid bumping or injuring the access arm.
- Don't carry heavy items using the access arm.
- Don't wear tight clothing or jewelry on the access arm.
- Don't sleep on the access arm.
- Don't allow blood pressure readings, blood testing, or injections in the access arm.
- Don't use the access for anything other than dialysis.

Peritoneal Dialysis

Preventing Peritonitis

- Wash your hands before treatment and exit site care.
- Perform exit site care as directed and report any signs and symptoms of infection immediately.
- Prevent constipation.
- Inform the home nurse well in advance of any scheduled colonoscopy, gynecologic, or dental procedures.
- Report any contamination (accidental separation or touching, leaks, holes, or tears) to the home nurse.

Family caregiver instructional videos about home dialysis can be found on AARP's website:



Taking Care of the Vascular Access for Home Hemodialysis

<http://links.lww.com/AJN/A193>



Preventing Peritonitis in Home Peritoneal Dialysis

<http://links.lww.com/AJN/A194>

For additional information, visit AARP's Home Alone Alliance webpage:

www.aarp.org/nolongeralone.



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venipuncture, or injection. The vascular access should only be used for dialysis. Restrictive clothing or jewelry should not be worn on that arm, and the patient should avoid using it to carry heavy items. Care should be taken to avoid leaning on this arm while sleeping. When assisting with ambulation or transfer, caregivers should be cautious around this arm and the access.

Emphasize that hand hygiene should be performed before touching the access, and gloves should be worn if the access is new and the wound is still healing. If the vascular access is an arteriovenous fistula or arteriovenous graft, patients and caregivers should be instructed to assess for patency by palpating for the thrill and auscultating the bruit.¹⁰ The thrill is a vibration felt by lightly pressing the fingers over the vascular access, and the bruit is a “swooshing” sound made by the blood moving through the access. It is not necessary for the patient or caregiver to have a stethoscope to hear the bruit. It can usually be heard by simply placing the ear over the access. Patients and caregivers should be taught to check for the thrill and the bruit daily. The absence of a thrill or bruit suggests that the arteriovenous fistula or graft may be clotted or otherwise not functioning. Any suspected clotting or infection should be reported to the home dialysis nurse as soon as possible.¹¹ Assess circulation in the area distal to the access by palpating the pulse and observing capillary refill in the fingers or toes, if the access is in the leg. Numbness, tingling, altered sen-

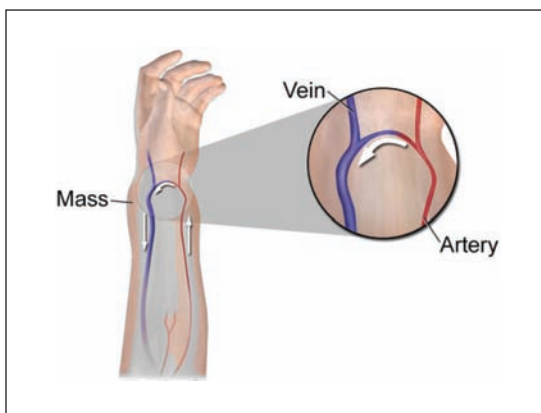


Figure 1. An arteriovenous fistula is a surgically created direct connection between an artery and a nearby vein. Images are from the Medical gallery of Blausen Medical 2014. *WikiJournal of Medicine* 2014;1(2): https://en.wikiversity.org/wiki/WikiJournal_of_Medicine/Medical_gallery_of_Blausen_Medical_2014.

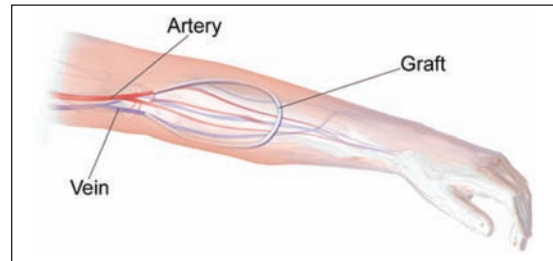


Figure 2. An arteriovenous graft is a surgically created connection between an artery and a vein using an implanted, usually synthetic material.

sation, temperature, and pallor should also be assessed in the extremity. Assess the access for signs and symptoms of infection, such as redness, tenderness, warmth, edema, and purulent drainage.

Hemorrhage. The patient should be observed for bleeding after dialysis. According to Jose and colleagues, hemorrhage may be due to complications of the vascular access, such as aneurysm formation and bacterial infection; patient factors, such as multiple comorbidities and medications; and dialysis-related factors, such as the separation of bloodlines during treatment, needle dislodgment, or catheter disconnection or dislodgment.¹² A retrospective case review conducted by the Centers for Disease Control and Prevention found that most fatal vascular access hemorrhages occurred in the patient's home or a nursing home, and the majority of patients had experienced vascular access complications in the previous six months, with the most common complications being infection and a history of vascular access hemorrhage.¹³ Fatal vascular access hemorrhage is rare, but it can be prevented by educating patients and their caregivers to take emergency steps if bleeding occurs.^{11,13} Ball emphasizes that patients and caregivers must know to apply direct pressure for at least 10 minutes while elevating the ruptured area above the level of the heart, using gravity to slow the flow of blood.¹¹ They should not use a towel, which can act as a wick, resulting in more blood loss. If bleeding stops after 10 minutes, the caregiver should continue to observe the patient for an additional one to two hours. If bleeding does not stop or cannot be controlled, the caregiver should call 911.¹¹ This is one time when the nurse should not be contacted first, as this is a medical emergency.

Teaching the patient or caregiver to use a tourniquet is controversial.¹¹ In addition to the potential for loss of the limb, there is concern that valuable time might be lost looking for the tourniquet rather than treating the patient or calling for assistance. There is also concern that the patient or caregiver

might not remember how to use the tourniquet. It may be wise, however, to teach those who live alone or have a vascular access hemorrhage risk factor—such as an aneurysm of the access or high flows resulting from hypertension or stenosis—how to apply a tourniquet. Commercially available tourniquets are easier to apply and safer to use than scarves, belts, or strips of fabric. Nurses can help to ensure caregiver preparedness by asking them to bring the tourniquet to the clinic or office, where they can demonstrate its application and the nurse can provide feedback.

PERITONEAL DIALYSIS

With peritoneal dialysis, dialysate is infused into the peritoneum via a catheter. The fluid then dwells there for a prescribed period of time before being drained.¹⁴ This cycle of fill, dwell, and drain is known as an exchange. The dialysate is a hypertonic dextrose solution which comes in concentrations of 1.5%, 2.5%, or 4.25% and is prescribed based on the patient's volume status.

Peritoneal dialysis can be performed through manual exchanges, called continuous ambulatory peritoneal dialysis. With this type of peritoneal dialysis, there are typically three or four daytime exchanges, with a long overnight dwell time. Peritoneal dialysis may also be automated, using a machine called a cycler. This is called continuous cycling peritoneal dialysis or automated peritoneal dialysis. With continuous cycling peritoneal dialysis, there are typically four or five exchanges performed via the cycler at night, while the patient sleeps. The last fill remains in the patient's abdomen during the day, in the same way that the night exchange does with continuous ambulatory peritoneal dialysis. The prescribed dwell time typically ranges from one and a half to four and a half hours but varies based on the type of peritoneal dialysis.¹⁴

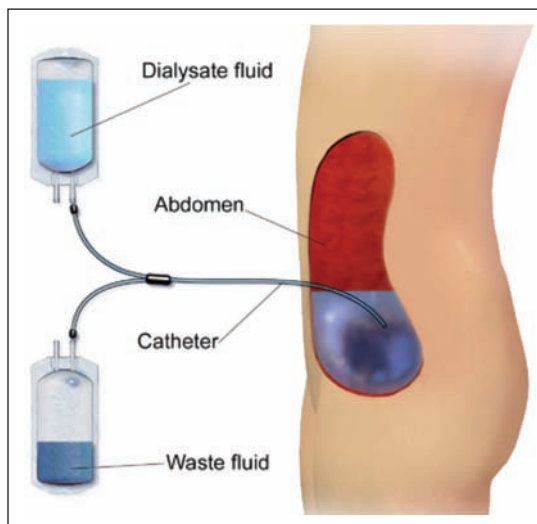


Figure 3. Catheter placement with continuous ambulatory peritoneal dialysis.

before the exit site, which is usually on the lower abdomen (see Figure 3). However, in the case of a presternal catheter, the exit site is on the anterior chest. Presternal catheters may be used in patients with ostomies, with incontinence, or who have obese abdomens.¹⁵

Access management. In the immediate post-operative period, the dressing should be changed weekly, using sterile technique. Nonocclusive dressings should be used, enabling any drainage to dry. Also, the catheter should be immobilized to promote healing and reduce trauma. A wet dressing should be changed immediately. The patient should not bathe or shower during this immediate post-operative period.¹⁵ After the exit site has healed, sterile dressings are no longer required. Patients and caregivers should be taught to perform exit site care at least twice a week. Handwashing

Exit site care provides the opportunity to assess for signs of infection, such as erythema, tenderness, or drainage.


Crabtree and colleagues recommend the use of a silicone catheter with either a straight or a coiled tip and two Dacron cuffs.¹⁵ The catheter is placed low in the pelvis, with one cuff placed in the rectus muscle and the second in the subcutaneous tunnel, just


should be completed prior to touching the catheter or exit site. Clean the exit site with liquid soap or an antiseptic that is noncytotoxic, using a clean washcloth and towel.¹⁶ Attention must be given to the concentration of the cleansing agent. Examples



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Resources for Nurses

 Taking Care of the Vascular Access for Home Hemodialysis^a
<http://links.lww.com/AJN/A195>

 Preventing Peritonitis in Home Peritoneal Dialysis^a
<http://links.lww.com/AJN/A196>

^a Family caregivers can access these videos, as well as additional information and resources, on AARP's Home Alone Alliance web page: www.aarp.org/nolongeralone.

of cytotoxic cleansing agents include povidone iodine at concentrations greater than 0.001%, hydrogen peroxide at concentrations greater than 0.003%, sodium hypochlorite at concentrations greater than 0.24%, and chlorhexidine at concentrations greater than 0.005%.¹⁷ A daily topical application of an antibiotic, such as gentamicin cream 0.1% or mupirocin cream or ointment 2%, is recommended.¹⁶ Exit site care provides the opportunity to assess for signs of infection, such as erythema, tenderness, or drainage. The tunnel and cuff should be palpated for tenderness and induration. Teaching patients and caregivers to report the signs and symptoms of exit site infection to the home dialysis nurse, along with appropriate antimicrobial therapy, will minimize the risk of peritonitis.¹⁶

be drained and sent to the laboratory for culture and sensitivity, Gram stain, and cell count. For patients who do not currently have fluid in their abdomen, caregivers should know to instill one liter of dialysate and allow it to dwell for one to two hours before sending it to the laboratory for assessment.¹⁶ According to the International Society for Peritoneal Dialysis, peritonitis should be diagnosed “when at least two of the following are present: (1) clinical features consistent with peritonitis, i.e. abdominal pain and/or cloudy dialysis effluent; (2) dialysis effluent white cell count > 100/ μ L or > 0.1×10^9 /L (after a dwell time of at least two hours), with > 50% polymorphonuclear; and (3) positive dialysis effluent culture.”¹⁶

Treatment should begin as soon as the specimen is obtained. Muthucumarana and colleagues found that each hour delay in the initiation of antibiotic therapy was associated with an increase in the risk of peritoneal dialysis catheter loss and death.¹⁸ Empirical therapy should include coverage for both gram-positive and gram-negative organisms and be administered through the peritoneum.¹⁶ In some cases, patients and caregivers are given antibiotics to keep at home and use if needed, ensuring treatment can be initiated promptly. When needed, the nurse should review with the patient and caregiver the process

During an episode of peritonitis, peritoneal permeability to water, glucose, and proteins may increase.

Peritonitis. Peritonitis is an inflammation of the peritoneum typically caused by an infectious organism. It is a common and serious complication of peritoneal dialysis and a significant reason why a patient would need to switch from peritoneal dialysis to hemodialysis.¹⁶ Potential risk factors for peritonitis include technical errors, hypoalbuminemia, a lack of vitamin D supplementation, hypokalemia, prolonged use of antibiotics, constipation, exit site and tunnel infections, exposure to animals (they should not be allowed in the room where peritoneal dialysis is being performed), depression, and obesity.^{16,17}

Patients who have cloudy effluent should be presumed to have and be treated for peritonitis until a diagnosis can be confirmed or excluded.¹⁶ When peritonitis is suspected, the effluent needs to

for adding the medication to the dialysate bag and provide instructions for follow-up.

Patients and caregivers also need to know how to manage the symptoms of peritonitis. Abdominal pain associated with peritonitis is usually generalized and occasionally associated with rebound tenderness.¹⁶ If the patient is experiencing pain, one or two rapid exchanges before the administration of antibiotics may be used to alleviate discomfort; however, Li and colleagues note there is no evidence to support this approach.¹⁶ Some patients require analgesics to manage the pain. For patients with cloudy effluent, heparin 500 units per liter may be added to the dialysate bag to prevent occlusion of the catheter from fibrin, which are white clots formed as part of the inflammatory response.¹⁶ During an episode of peritonitis, peri-

toneal permeability to water, glucose, and proteins may increase. To avoid fluid overload, hypertonic solutions or more frequent exchanges may be needed. For the same reason, patients with diabetes may require insulin adjustment owing to more rapid glucose absorption.¹⁶

Prevention. Prevention of peritonitis begins with placement of the peritoneal dialysis catheter. Systemic prophylactic antibiotics should be administered prior to the insertion of the catheter.¹⁶ Exit site care should be performed as ordered, and patients and caregivers should be taught how to prevent peritonitis. Emphasize the need for meticulous hand hygiene before each treatment or exchange and prior to performing exit site care.¹⁶ Constipation and diarrhea should be prevented as much as possible. People receiving dialysis treatment are at a greater risk for constipation as a result of restrictions on fluid intake. Most patients should have orders for stool softeners and laxatives, as needed. The patient or caregiver should inform the home dialysis nurse well in advance of any scheduled colonoscopy, gynecologic, or dental procedures, so prophylactic antibiotics may be prescribed.¹⁶ Ensure patients and caregivers know to report any contamination of the system—such as accidental separation, leaks, holes, or tears in the catheter or tubing, or accidental touching of a sterile portion of the system—to the home dialysis nurse. The nurse typically changes the transfer set attached to the catheter every six months, but contamination or damage may necessitate that it be changed sooner.

PATIENT AND FAMILY CAREGIVER EDUCATION

Beginning dialysis treatment at home can be stressful. Emphasize to caregivers that by carefully managing the access, whether a vascular access or peritoneal dialysis catheter, they can help to ensure effective treatment and patient safety. Educating patients and their caregivers on potential complications and emergencies can also help to empower them. Hemodialysis patients and their caregivers should be taught what to do in case of hemorrhage and when to call for help. Peritoneal dialysis patients and their caregivers should notify the dialysis provider any time they believe they may have contaminated the system or when they detect cloudy effluent or the patient has abdominal pain. They should know to save the bag for a culture and ask the nurse for instructions regarding obtaining and administering antibiotics. Teaching patients and family caregivers how to respond to these complications can also help to minimize any fear caregivers may have of causing the patient pain or of failing to act when needed. ▼

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