Chapter 13
Peritoneal Dialysis Program Organization and Management

The Nurse's Role

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Peritoneal dialysis (PD) has been a successful mode of renal replacement therapy with a positive response from patients [1]; however, there has been a progressive decline in patient recruitment for this self-care modality and in the total number of PD patients in the United States [2, 3]. This has contributed to a lack of clinical experience and expertise in PD, and loss of the infrastructure crucial for successful implementation of PD therapy. This is both a cause for concern and a distinct challenge.

As a renal replacement therapy, PD can be individualized for each patient's specific clinical and psychosocial needs [4, 5]. Also, the patient who assumes responsibility for self-care can benefit from the flexibility and freedom that PD offers.

The success of PD as a renal replacement modality in an ever-changing healthcare arena is dependent on the commitment and efforts of all members of the PD healthcare team [6]. This chapter will discuss the development and organization of a PD home program [7, 8] and the nursing roles in providing care to PD patients [9–13].

Structure and Function of a PD Program

Establishing the foundations of the PD program should be the shared responsibility of the medical director and PD nurse manager. Defining each team member's responsibilities and writing the position description is one of the first steps in program development. Clarifying the specifications of the physical environment and ordering the necessary equipment is often the next step [14, 15]. Other critical elements include creating policy and procedures and training protocols, developing quality outcome management strategies, and financial planning [7, 8, 16–18].

The Healthcare Team

The clinical care and support of the self-care PD patient is a team effort. The team is comprised of a central core of healthcare providers and a peripheral group of specialty consultants (Table 13.1) [19–22]. Core members of the PD healthcare team include the nephrologist, access surgeon, PD nurse, advanced practice nurse [22], dietitian, and social worker. Some larger PD programs have successfully integrated a technician role [19, 20]. The core team members collaborate with the patient's primary care physician and other healthcare professionals who contribute to the care of PD patients. It is often the PD nursing staff who coordinate the efforts of the team to provide home care for the PD patient [12, 13].

The Physical Environment

Developing a safe, functional environment for a PD program requires strategic planning. The PD nurse needs to be involved throughout this process to provide the necessary nursing perspective. Table 13.2 lists essential elements of the physical plan for a PD home program [7, 8, 14, 16, 17].

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Table 13.1 Healthcare team members

Core PD team members
• Patient
• Nephrologist
• Peritoneal dialysis nurse
• Dietitian
• Social worker
• Renal fellow
• Access surgeon
• Advanced practice nurse
Consulting physicians
• Primary care physician
• Infectious disease specialist
• Diabetologist
• Gerontologist
• Psychologist/psychiatrist
• Hospitalist
• Vascular surgeon
Other care providers
• Transplant team
• Research staff
• Hospital nursing staff
• Extended care facility staff
• Rehabilitation facility staff
• Hemodialysis staff

Table 13.2 Physical requirements for the peritoneal dialysis program

• Waiting room or reception area
• Training room(s)
• Clinic rooms
• Conference room
• Staff office(s)
• Restrooms for patients and staff
• Clean utility room
• Dirty utility room
• Supply storage area
• Secured area for patient records, computerized records, printers, copy and fax machines

Planning should focus first on safety for patients and staff. Hallways and training rooms need to be large enough to accommodate wheelchairs, stretchers, and emergency equipment. Training rooms must be large enough to accommodate the nurse, patient, and family members. A larger room may be constructed for group training.

To prevent falls, the floor covering should not be slick or slippery; it should have some texture to promote safe footing. If part of the unit is carpeted, the carpet fibers should be short to prevent tripping and to allow effective cleaning. Light-colored, washable paint should be used to reduce glare. Large windows will need shades or adjustable blinds to filter sunlight and prevent glare. The training room needs to have a thermostat so the temperature can be adjusted to the comfort level of the individual patient [23].

Table 13.3 outlines equipment required for a PD program. Sturdy furniture should be selected to provide comfortable seating for patients and family members. Wheeled chairs should have locking wheels to prevent falls and to provide secure seating. Each training room must have a table where the patient can sit comfortably to practice dialysis procedures. Additional counter space may be available to organize dialysis supplies and equipment. These surfaces must be constructed of a material that can withstand frequent disinfection with approved cleaning solutions.

Another concern regarding the physical environment is the ability to protect the patient's privacy and confidentiality. Training rooms and clinic rooms need doors rather than just curtains. The PD nurse needs an office or private

Table 13.3 Equipment requirements for the peritoneal dialysis program

- Chairs and table top working areas
- Cabinets for supply storage
- Sinks for hand washing
- Wall-mounted soap dispensers and hand sanitizers
- Portable IV poles or ceiling-mounted hooks for solution bags
- Patient scales
- Scales for weighing dialysis solution bags
- Wall-mounted clocks
- Wall-mounted sphygmomanometer
- Automatic sphygmomanometer
- Dialysis cycler
- Device(s) to heat dialysis solutions
- Refrigerator
- Computers, printers, copy machine, fax machine
- Wheelchair

area to provide patient counseling and to make confidential phone calls. The area where medical records are stored must be able to be locked when not in use. Electronic medical records must be protected with passwords and security screen locks. Fax machines must also be located in a restricted area and a confidentiality statement must be included on the first page of all faxed transmissions that include patient information.

Policy and Procedure Development

Federal regulations mandate that each PD program have a policy and procedure manual. This manual should include all patient care procedures, written patient education materials, position descriptions, and strategies for outcome management. Table 13.4 outlines components of a policy and procedure manual. The initial effort of developing a procedure manual will be outweighed by the long-term benefits.

Policies and procedures should be evidence-based whenever possible. Several evidence-based practice guidelines have been published in recent years [24–26]. These provide detailed information describing which practices and procedures are supported by scientific data, the level of the scientific evidence, and key references. The International Society for Peritoneal Dialysis (ISPD) and national societies have also published guidelines and recommendations for clinical care [27–29]. Reviews of controlled clinical trials [30–32] and best demonstrated practices [33, 34] have also been published.

After the PD program is successfully underway, periodic review and revisions to the policies and procedures are mandated by regulatory guidelines. Typically, the policy and procedure manual is reviewed and revised annually to reflect current practice and to meet regulatory requirements; however, individual sections may require updates between annual reviews.

The medical director and PD nurse manager will also need to develop mechanisms to review clinical outcomes, and note changes in regulatory mandates, insurance parameters, and current standards of care. The review of clinical outcomes may be accomplished through weekly dialysis rounds, monthly summaries of care, an annual report of program outcomes, and the continuous quality improvement program. The clinical outcomes should be compared to regional and national benchmarks [35–39] and recently published data.

Patient and staff education materials are essential for successful home dialysis. Patient education materials are available from equipment and supply manufacturers, others have been published or are available on the internet [40, 41]. Patient education materials should be available in a variety of formats and media [42]: written and illustrated [43], audio [44] and video, “hands-on” [45], and interactive [46]. Besides unit-specific procedures and education materials, patients should be given a list of resources including websites [41]. The nursing staff will also need reference books (e.g., drug manuals, nephrology, dialysis, and nursing textbooks), current journal subscriptions and resource lists including websites.

A copy of the patient’s bill of rights should be included in the patient’s home training manual and posted in the dialysis unit. Some home dialysis units also include a list of patient responsibilities.

Table 13.4 Components of a peritoneal dialysis program policy and procedure manual

- Mission statement
- Goals and objectives
- Role descriptions for the peritoneal dialysis team members
- Description of the CKD patient education program
- Content outline for the initial interview process
- Catheter insertion protocol
- Procedures
  - Care of the newly inserted catheter
  - Care of the established catheter
  - Hand washing
  - Daily hygiene
  - Exit site care
  - Management of exit site infection
  - Management of peritonitis
  - Obtaining dialysate specimens
  - Manual CAPD
  - Automated PD
  - Capping of catheter
  - Changing transfer set
  - Addition of medications to dialysis solutions
- Fluid balance guidelines
- Use of heparin and nonheparin alternatives
- Recognition of complications
- Problem solving techniques
- Obtaining vital signs in the home setting
- Home records
- Protocols
  - Development of patient care plan
  - Assessment forms
  - Obtaining consent
  - Advance directives
  - Confidentiality protection
  - Incident reports
  - Training sessions
  - Home visits
  - Clinic visits
  - Telephone follow-up
  - Annual retraining
  - Travel
  - Disaster preparedness
  - Emergent and non emergent hospitalizations
- Samples of all program-specific educational materials
- Procedures for routine monitoring of quality indicators

Patient Safety

All electrical equipment in the PD unit must be checked for electrical hazards, approved for use, and routinely maintained.

Appropriate emergency equipment and medications must be available and all members of the nursing staff will need to maintain certification in cardiopulmonary resuscitation (CPR). Some institutions require that support staff also be certified in CPR. Emergency drills should take place periodically to provide the staff with education and experience in how to function in a life-threatening emergency.

To protect all patients, visitors, and staff, a unit-specific fire plan must be developed. A written fire plan should be posted and emergency contact numbers need to be in view for easy accessibility. All staff must know the location of fire alarms, fire doors, fire extinguishers, and evacuation routes. Periodic fire drills are mandatory.

Infection Control

Practices in the Peritoneal Dialysis Unit

A number of practices recommended to reduce the transmission of disease in hospitals, ambulatory care settings, and hemodialysis units are appropriate of peritoneal dialysis units [47–51]. These are summarized in Table 13.5 and discussed below.

Handwashing

Effective handwashing remains one of the most effective strategies to prevent the transmission of diseases in health care facilities. The Centers for Disease Control and Prevention (CDC) recommends handwashing after removing gloves and between patient contacts [47]. Handwashing procedures must be developed for both the dialysis unit and for the patient in the home environment. Many units promote the use of an antibacterial liquid soap in a pump dispenser in the home when many family members are using the same sink(s) for handwashing. This may prevent sharing of bacteria that might accumulate on bar soap. The current guideline for hand hygiene in healthcare settings reviews studies and provides recommendations to improve hand hygiene practices [52]. This document also summarizes recent studies related to alcohol-based hand rubs. These "waterless" disinfectants have been shown to remove microorganisms effectively and take less time than conventional handwashing [53]. Studies have shown that there is less irritation to hands [53, 54] and increased compliance with hand hygiene among healthcare workers [53, 55].

Although we found no studies specifically related to use of alcohol-based hand cleansers in peritoneal dialysis, these are being used both in the clinics and by patients and partners dialyzing at home. They could be used routinely when PD procedures call for handwashing, instead of soap and water (when hands are not visually soiled). This would eliminate the problem of increased transfer of microorganisms when hands are washed but not thoroughly dried [56]. Waterless cleansers could be also be used when the patient is connected to the cycler and may not be able to reach a sink, and whenever a continuous ambulatory peritoneal dialysis (CAPD) patient is performing procedures in a

Table 13.5 Recommendations to reduce disease transmission [47–51]

Immunizations
• Routine serologic testing for hepatitis B and C
• Vaccination for all patients susceptible for hepatitis B
• Test for anti-HBs 1–2 months after series is complete
• Retest annually and give booster immunization if necessary
Injections
• Use single-use syringes and needles
• Use single-dose medication vials or prefilled syringes whenever possible
• Perform hand hygiene before preparing and administering an injection
• Prepare injections in a designated medication room or area
• Use aseptic technique to prevent contamination of sterile equipment and medications
• Dispose of syringes and needles in an approved container at the point of use
Venipuncture
• Use barriers when drawing blood to prevent blood from contaminating surfaces
• Perform hand hygiene before donning gloves and after removing gloves
Equipment
• Handle equipment that might be contaminated with blood in a way that avoids contact with skin and mucous membranes
• Evaluate equipment and devices for the potential for cross-contamination
• Establish procedures for safe handling and effective cleaning
• Maintain physical separation between clean and contaminated equipment and supplies
Exposure to blood
• Wear gloves for procedures that might involve contact with blood
• Perform hand hygiene after inadvertent blood contamination
Other
• Clean and disinfect training and clinic rooms between patients
• Routine infection surveillance
• Infection control education

location where there is not access to running water. It is also possible that the use of waterless hand cleansers might increase compliance with handwashing by PD home patients.

Immunizations

Pneumococcal pneumonia and influenza vaccines are recommended for patients with chronic illnesses, and the hepatitis B vaccination series is recommended for patients on dialysis therapy [49]. Each dialysis unit should be prepared to provide these immunizations or refer patients to a local health department, if the immunizations are not given in the physician's practice. All immunizations must be documented in the patient's medical record, including the date of immunization, location of injection, drug lot number, and occurrence of any unusual reaction. A copy of the documentation should be given to the patient.

Dialysate Disposal

Another aspect of patient safety is the disposal of infectious waste. The procedures for disposal of peritoneal dialysis effluent will vary depending on the physical layout of the PD unit. Waste maybe disposed in a designated waste sink in the training room or in a central waste disposal area. When transferring dialysate to the central disposal area, it must be handled in a manner that prevents contact with clothing, skin, and mucous membranes. Some units use plastic bags designated for infectious waste for this purpose. The PD nurse must use standard precautions to protect him/herself and other members of the staff when emptying the dialysate bags. A face shield, gloves, and protective gown or apron should be worn when handling the dialysate. A mask might also be worn when handling dialysate from patients with known tuberculosis, as transmission has occurred from inhaling aerosolized mycobacteria [47]. The bags and tubings should be discarded in a designated hazardous waste receptacle. Spills of effluent must be cleaned with an approved bactericidal/virucidal solution.

At home, dialysis patients typically discard dialysate in the toilet or a sink. Patients who use dialysis cyclers with an open drain line should be instructed to ensure that the tip of the drain line is not submerged below the water level in the toilet or drain [47]. Procedures for dialysate disposal at home should include warnings against splashing, instructions regarding how to clean spills, and how to clean the sink or toilet used for dialysate disposal, and appropriate cleaning solutions. If a family member or someone other than the patient is disposing of the dialysate, they should use the protective garb similar to that recommended for the staff.

Quality Improvement Program

The quality improvement program provides data collection, evaluation, and outcome management for an interdisciplinary team effort [57] in promoting excellence of care. In many countries, establishing a quality improvement program is not optional, but is a regulatory requirement. All quality improvement efforts monitor and assess clinical outcomes and make changes in the processes of care with the ultimate goal of providing efficient, effective, and safe patient care, which will result in improved patient outcomes [8, 58].

Table 13.6 provides examples of outcomes that may be monitored in a quality improvement program. At a minimum, PD-related infections [27], catheter survival [59, 60], patient survival, and technique survival (proportion of patients remaining on PD therapy) should be monitored. Data may be collected and analyzed on a monthly, quarterly, or annual basis, depending on the size of the program and the frequency of the outcome. Outcomes can be compared to data from national registries and published reports [35–39]. Review of the literature, particularly abstracts from nursing and multidisciplinary meetings, and networking with other programs are helpful when initiating a quality improvement program in order to obtain ideas about data collection strategies and experiences in making timely changes to improve outcomes.

Each program needs to adopt or develop a system to routinely collect information. Designing a tool to collect the information on a monthly basis is often a simple, effective method of documenting outcomes. This may be a simple tool to manually enter the data or a computer program to collect and analyze the information. Reports can also be generated by the program's Medical Information System (MIS) of computerized patient records. The data collection may be a shared responsibility of all the team members or it may be the sole responsibility of one nurse.

Inherent in the continuous quality improvement (CQI) process is the need for several members of the interdisciplinary team to meet periodically, discuss the outcomes, analyze the contributing factors (root cause analysis), and plan strategies to improve outcomes. Typically, it is a nurse who coordinates the quality team; however, multidisciplinary participation,

Table 13.6 Outcomes for continuous quality improvement projects

Adequacy of dialysis
Technique survival (time on peritoneal dialysis)
Access
• Catheter demographics
• Catheter survival
• Catheter-related infections
○ Exit site infection
○ Tunnel infection
○ Peritonitis
• Catheter complications
PD complications
Hospitalizations for dialysis complications
Fluid balance and hypertension
Nutrition
Metabolic parameters
• Serum albumin and protein
• Anemia management
• Calcium/phosphorus balance
• Electrolytes
• Glucose management and control
• Secondary hyperparathyroidism
Effectiveness of patient education program
Psychological adjustment to PD

including that of a committed physician, is critical to its success [57]. The team process facilitates the implementation of changes required to achieve excellent outcomes and promote PD as an effective renal replacement modality.

Another component of quality assessment and improvement is to solicit feedback from the patients regarding the care they receive [1, 61]. Patient satisfaction surveys that guarantee anonymity and are returned to an address or individual separate from the home dialysis program can provide surprisingly candid feedback pointing out problems in delivery and effectiveness of care. It has been suggested that the process of care has a strong impact on retention of chronic PD patients [62], so responding to patients' concerns may improve patient retention.

CQI efforts in PD programs have resulted in increasing the number of patients who choose PD therapy [63–65], reducing infections [66–80] and amputations [81], changing procedures for home care interventions [67, 68, 72–74, 76, 80], and identifying strategies to improve dialysis adequacy [77, 82–84], fluid balance [85], nutrition [86], bone health [87, 88], and anemia [89]. The CQI effort also promotes the development of a team identity and, in some instances, may improve communication and reduce adversarial relationships.

Financial Considerations

Fiscal responsibility is important for the long-term success of the PD program. Prudent use of supplies and medications can be achieved through staff and patient education and an organized approach to inventory levels. Each program will have a unique approach to cost effectiveness based on methods of supply ordering, vendor contracts, and available storage space.

A technical assistant or secretary can be taught to participate in supply inventory, computerized billing, tabulating monthly charges, and staff payrolls, with supervision from the nurse manager. A dialysis technician can also participate in these activities and save personnel costs in large programs [19, 20].

Establishing a good working relationship with the home supply team is vital to insure that the patient has the appropriate home supplies but does not accumulate excess or outdated supplies, thus avoiding waste and expensive emergency deliveries.

The PD nurse may be supported by administrative staff in assessing PD program costs, but must take an active role in this process. Developing an internal communication process for transmitting information regarding patient training days, episodes of care, and billing for supplies and drugs is critical. Networking with the individuals who are responsible for the billing process also contributes to effective billing. Often, the nurse must educate the billing staff regarding aspects of clinical care to help them understand the often-complicated billing process for the home dialysis patient.

Table 13.7 Legal strategies to manage risk

Program is structured to comply with all state and federal regulatory requirements
Clinical care
• Consent for procedure(s) signed by patient or proxy
• Patient rights are posted and a copy given to patients
• Documentation of advance directives
• Physician orders for all treatments
• Patients and families are treated in a professional and caring manner
• Patient privacy and confidentiality are respected and documented
• All patient interactions and interventions are documented
• Patient plan of care signed by patient and team members
• Periodic review of patient's skills and knowledge and retraining if indicated
• Incident or unusual occurrence forms completed as necessary
Staff roles
• Position descriptions for all team members
• Competencies listed for each position
• Competencies are evaluated and documented for each staff member
• Team members must function within defined competencies
• Nurse should not dispense medications for home use

Cost accounting should be done by the PD nurse on a monthly basis so that the acquired revenue can be compared to the program's activities. This can include a record of clinic visits, training sessions, home visits, on-call activity, staff educational sessions, and supplies for the home patient and the dialysis unit. In some instances, the PD nurse is involved in the development of the annual budget. Insights from the budget planning process and monthly cost accounting can be very helpful in understanding the program's financial stability, and increases the nurse's investment in maximizing efficient supply ordering and effective billing [7, 17].

Legal Considerations

PD is a unique specialty within the practice of nephrology medicine and nursing. The PD nurse often functions in an autonomous role while providing quality care for the home dialysis patient. Providing legal protection of both the patient and staff must be a key part of the program's philosophy and policies [90]. The policy and procedure manual must be very specific in delineating the role of each core team member. Job descriptions need to be specific and current. The nurse must be careful not to exceed defined boundaries (e.g., in many countries, only a physician or pharmacist may dispense prescription medications) and must document patient care consistently and objectively.

The healthcare team should not hesitate to obtain professional legal advice for complicated patient situations [90]. Sources of assistance in the hospital setting or large dialysis organizations are the risk management team, designated patient advocates, and the ethics committee [91]. Table 13.7 summarizes strategies to manage legal risks in a home dialysis program.

Education of the Patient with Chronic Kidney Disease

One of the first tiers of education is that which is provided for the patient with chronic kidney disease. This takes place prior to the initiation of renal replacement therapy. The newly diagnosed patient with chronic kidney disease is faced with many life-altering changes that maybe both overwhelming and confusing. Efforts to provide excellent predialysis care include early detection, strategies to slow disease progression, prevention of uremic complications, education regarding therapy options, and the timely start of renal replacement therapy [92–100].

One key to successful predialysis management is the timely referral of the patient to a nephrology practice where a nephrologist or a nurse practitioner can individualize the patient's care and education. The newly diagnosed patient often focuses on the term *end-stage renal disease* and can become frightened and discouraged, so identification and regard for the patient's fears and anxieties must be foremost in the minds of the care providers. It is important to establish an atmosphere of trust.

Early interventions include nutritional counseling, hypertension education, and medication reviews. The patient may initially obtain the most information and education from the dietitian and the nephrology practice nurses; however, in some nephrology practices, specific education strategies and programs are in place that require participation of the PD nurse, hemodialysis nurse, social worker and transplant team. This allows the patient to meet and develop an early relationship with members of the renal replacement therapy team [1]. Other programs refer patients to predialysis education programs or dialysis education activities based exclusively in the home dialysis program [6].

Utilizing an integrated care approach to support the patient in choosing the right modality at the right time in the course of chronic kidney disease (CKD) is the responsibility of the both the nephrology and dialysis teams [101–103]. Timely education and decisions about dialysis modality also support PD, because often the CKD patient who develops uremia and starts hemodialysis emergently does not have the opportunity to then change to PD due to logistical barriers [5, 6, 104].

Providing predialysis education helps the patient understand the disease process, monitor and control hypertension, medications, strategies to preserve residual renal function, and renal replacement therapies. It should also create a supportive environment that allows the patient to ask questions and voice concerns. The patient then has the necessary information to make an informed choice of the mode of renal replacement therapy [5, 6, 101–103]. This early relationship and patient education may also help to promote adherence and the development of self-care management skills.

Renal replacement therapy options must be carefully presented without bias. All CKD patients should have the benefit of education about PD, hemodialysis, and transplant candidacy. Although PD is primarily a self-care therapy, patients who are not physically or mentally able to assume the responsibility for dialysis have done PD successfully with the assistance of family members, friends, or contracted care providers. Predialysis education can be accomplished by a variety of methods, but should be based on principles of adult education [105–110], with a chronic disease focus [111]. Individual counseling is appropriate for all patients, but group classes may also be helpful for the patient and family members, and classes utilize staff time more efficiently. For the patient who is unusually anxious, it is often helpful to provide an opportunity to meet with an established dialysis patient. The questions and information sharing are based on actual personal experience. These encounters are often rewarding and may be valuable for all prospective dialysis patients [112].

Participation in predialysis education is a valuable opportunity for the PD nurse and other PD team members. Their participation in early intervention and early education can contribute to recruitment of prospective PD patients. Key to retaining the interest of patients in PD is periodic follow-up and response to the patient's questions and concerns. The PD nurse must also communicate with the referring primary care physician and nephrologist.

Interviewing Prospective PD Patients

The interview process provides an opportunity to share information with the patient and family members about PD while establishing a relationship the prospective home dialysis patient. The interview may be part of the predialysis education program or take place later, after the patient has chosen PD. Knowledge of dialysis modalities and participation in the decision about type of renal replacement therapy promote the development of a sense of control early in the patient's dialysis experience. The patient learns to actively participate in his care. This can help to control fear, reduce anxiety and establish self-care skills. Developing this confidence may also promote adherence to the plan of care [113–115].

To prepare for the interview, the PD nurse should review the patient's medical history and prior experience with health care. Goals should be set for the interview and shared with the patient and family. Careful regard for cultural diversity and the patient's religious beliefs can aid in individualizing the process [112, 116, 117]. The patient with a language barrier must have the services of an interpreter. Whenever possible, this interpreter should not be a family member or friend so that unintentional bias or misinterpretation does not occur [116, 117].

The nurse must be competent in physical assessment, nursing diagnosis, and adult education and have good communication skills. Knowledge of chronic kidney disease management and renal replacement therapy options are also prerequisites. Utilizing this knowledge, the nurse then needs to individualize the information for each prospective patient. A successful interview will also depend on the nurse's compassion, understanding, and self-confidence [118, 119].

The physical environment is also important for a successful interview experience. The ideal setting would provide adequate lighting, a comfortable temperature, and comfortable seating for the patient and family in an environment that is free from distractions. Information should be directed to the patient with the family as the support system. The

nurse must also be a good listener and be ready to answer questions and validate the patient's fears and anxieties. The chronically ill patient will fatigue easily and the nurse must adjust the length of the interview based on the patient's tolerance. Allowing the patient to take a break and have refreshments may be helpful. Some patients may need a return appointment to complete the interview or to have time for questions and answers.

If the prospective patient has not had the opportunity to meet with a successful PD patient, this may be helpful. Asking questions of a fellow patient may not only provide information, but meeting a confident and successful PD patient may diminish stress and foster a positive approach to assuming self-responsibility [118].

Table 13.8 provides a sample outline for an initial interview. The nurse must be careful to select content that is important at the time of the interview. It may not be feasible to either obtain or offer as much information as desired, so it is important to individualize the interview. Using a written tool to collect information is recommended, and a documentation tool that follows the unit-specific interview outline can be developed.

There are additional issues related to interviewing the hospitalized patient. This patient is often sicker and under more environmental stress, and may need to make a more immediate decision about modality selection. Lack of privacy, lack of sleep, noise, and frequent interruptions can make the interview process challenging. If the PD nurse must interview the hospitalized patient, it is important to work with the hospital nursing staff to schedule an opportune time. Patients who are acutely ill and/or frankly uremic often must rely on family and significant others in making decisions, so they should be included whenever possible. The interview will need to be succinct and organized. Concise documentation of the content presented and the patient's response must be in placed in the hospital record to communicate with other healthcare providers [118].

Patients may also choose to transfer to PD later in the course of renal replacement therapy. The established hemodialysis patient may decide to switch to PD due to lifestyle issues, dissatisfaction with hemodialysis, or clinical complications of hemodialysis. The patient with recurrent problems with vascular access may need to change to PD in order to survive. Also the patient with a failed transplant may choose to resume dialysis as a home PD patient.

Table 13.8 Interview outline for prospective peritoneal dialysis patients

Patient information

- Employed/student/retired/disabled
- Family and community support
- Hobbies/interests
- Access to transportation
- Travel

Assessment of language and education

- Language
- Level of formal education
- Reading level
- Previous chronic kidney disease education

Review of health status

- Primary diagnosis
- Co-morbidities
- Prior experience with renal replacement therapies
- Prior experience with self-care

Assessment of physical limitations

- Sight
- Hearing
- Impaired ambulation
- Tactile impairment
- Hand strength
- Limitations in activities of daily living

Assessment of home environment

- Type of home; utilities
- Other individuals sharing home
- Appropriate area for dialysis procedures
- Space for supply storage
- Pets in household

Source: Adapted from [118] with permission.

PD Access

Effective management of the PD access is essential for successful PD. This includes catheter selection, preoperative, perioperative, and postoperative routines, chronic catheter care, and analysis of outcomes. The PD nurse will need to fulfill the roles of educator, coordinator and evaluator in establishing a PD access program with positive catheter outcomes [120, 121].

The first step is to identify and communicate with the team members who participate in access management. This includes the nephrologists, surgeons, operating room staff, recovery room staff, and the hospital unit staff. It may also include the interventional radiology staff and individuals who purchase supplies. The PD nurse may need to meet with each member individually or in small groups to achieve a collaborative approach to access management. Follow-up may be done by telephone and email. In some programs, an access coordinator or nurse may be designated to manage the scheduling of both hemodialysis vascular access and PD catheter placement and interventional procedures.

The group must choose the catheter(s) that will be utilized by the program. There is a variety of catheters to choose from: single or double cuffed, straight or coiled, presternal, and catheters with or without a swan neck configuration [122–124]. Implantation techniques vary and may include surgical dissection, laparoscopic placement, and burying the external segment for future externalization of the catheter [123, 125, 126]. The choices should be based on research of the available catheters, the current data in the literature, and the surgeon(s)' and program's experience.

The nephrologist or nurse practitioner will make the initial referral for PD and catheter placement, and will be responsible for the short- and long-term management of the patient's care. The surgeon will evaluate the patient for catheter placement, implant the catheter, and provide surgical follow-up. In some programs, the surgeon may also be involved in long-term outcome management by reviewing catheter outcomes data or participating in quality meetings. If catheters are routinely placed in an interventional radiology setting, the radiologist or interventional nephrologist would be part of the quality team.

Table 13.9 PD catheter management routines [60, 121, 122, 124, 127–130]

Preoperative routine

- Patient selects peritoneal dialysis as renal replacement therapy
- Patient referred by nephrologist for catheter placement
- Peritoneal dialysis nurse educates patient and family about catheter placement routines and initial catheter care
- Patient is evaluated by surgeon; catheter exit site evaluated in both upright and supine positions
- Proposed catheter insertion and exit sites are marked
- Culture nares (if done at this unit)
- Consent for procedure is obtained
- Bowel , bladder, and skin preparation
- Patient reports to either hospital pre operative admission area, to transient outpatient area or other designated location on day of catheter placement

Perioperative routine

- If catheter is placed by surgical dissection or by laparoscopy, the patient will be cared for by the operating room team during the procedure
- Antibiotics are given before the start of the procedure
- Catheter patency is tested by infusing and draining
- Catheter is capped or appropriate tubing or transfer set is attached
- Dressings are applied to incision site and exit site per program protocol
- Catheter is secured to prevent traction at the exit site
- Surgeon will recommend when the catheter can be first used for dialysis exchanges

Postoperative routine

- Patient will be monitored either in a recovery room or in a transient care setting
- Pain control is provided
- Surgeon will determine if patient may return home or will be admitted for overnight observation
- Peritoneal dialysis nurse may flush catheter either in the hospital or transient care setting or arrange for clinic follow-up in 24 to 48 h
- Initial dressing per program policy may be removed either by surgeon, peritoneal dialysis nurse, or designee
- Prophylactic antibiotics (systemic and/or local) continued per unit protocol
- Patient is provided with written instructions for catheter care, bowel regimen, pain medication prescription, and follow-up appointment
- Emergency telephone numbers are provided and reviewed
- Follow-up appointments are arranged with the peritoneal dialysis outpatient program

Table 13.10 Components of catheter evaluation at routine clinic visits

- Inspect catheter and adaptor for cracks, splitting and leaks
- Inspect catheter exit site for dialysate leak and signs of exit site infection
- Inspect the abdominal wall for evidence of subcutaneous leak and hernias
- Monitor the flow of effluent during infusion and drain
- Monitor effluent for color, clarity, and the presence of fibrin
- Observe the patient for unusual pain or discomfort
- Periodic review of home exit site care procedures

The PD team needs to identify the responsibilities of each unit or staff member (e.g., the operating room nurses often participate in testing catheter patency, capping the catheter, and placing the surgical dressings), develop written protocols for catheter care procedures, provide initial staff education, and identify resources for these care providers. Outlines of preoperative, perioperative, and postoperative routines are listed in Table 13.9 [60, 121, 122, 124, 127–130].

Each program must develop specific procedures for maintaining catheter patency, including nonheparin alternatives. There must also be protocols for catheter obstruction [131], daily exit site care, and strategies to prevent infection. Also, effective procedures for catheter "break-in" help to maintain patency, facilitate wound healing, and prevent early leaks [132].

Long-term management of PD catheters is a crucial to insuring the patient's longevity on PD. Early identification of catheter complications [133] and catheter-related infections and prompt intervention are critical to catheter survival. All team members must agree on and follow exit site procedures so that the patient has the benefit of consistent care. A routine catheter and exit site assessment should be part of each clinic visit and hospital admission. Table 13.10 summarizes elements of catheter assessment. Catheter-related queries can also be incorporated when assessing the PD patient by phone.

A quality program for PD catheter outcomes helps to insure consistent monitoring and evaluation of access management. The nurse acting as a facilitator can utilize the documentation from routine catheter and exit site assessments to effectively track catheter-related problems and infections.

The PD nurse must also monitor the literature for evidence-based practices for exit site and catheter care and benchmarks for catheter outcomes [24, 59, 60].

PD Patient Education and Training for Home Dialysis

The foundation of a successful PD program is the provision of effective home dialysis training [134–137]. PD nurses often do not have formal training in education theories, methods, and strategies [138–141]. To successfully develop a program and successfully teach patients, the nurse must acquire this knowledge and related skills. Attending a formal education course or seminars, networking with colleagues, and developing a relationship with a mentor can prove to be excellent sources of information [139]. Each nurse must then take responsibility to periodically enrich his/her knowledge of the adult learning principles. Regional or national conferences offer opportunities for learning, networking, and informal sharing of experiences. An important investment for any dialysis unit is the purchase of adult education texts and resources [105–110]. Also, nephrology nursing textbooks include chapters on patient education [142, 143].

Although there may be generic learning objectives (Table 13.11) and a recommended list of content (Table 13.12), the educational program for each patient must be individualized. The cultural and religious background of the patient must be regarded when individualizing the patient education plan [116, 144, 145]. Patients who speak a different language should have the benefit of an interpreter who can translate the information in an unbiased manner. Utilizing an interpreter will lengthen the training sessions or increase the number of sessions. In general, the length of the training session is determined by the patient's degree of uremic symptoms, endurance, and attention span. Transportation requirements may also affect the scheduling and length of the session.

The patient and family must be included in scheduling sessions, deciding who will attend with the patient and arranging transportation. The patient should be the focus of each patient education session with the family member(s) providing support. When family members are training as dialysis partners or to provide back-up support, they will almost always have mastered the content by the time the CKD patient has; however, they will need to practice the procedures. Documentation should include verification that each individual who will be performing dialysis procedures has participated in the training and identify which procedures they can safely perform.

Table 13.11 Objectives for the peritoneal dialysis instructor

The PD instructor will:

- Provide an environment for effective learning
- Present an overview of the PD course
- Prepare learners for what they will learn and how both the learner and instructor will know that learning has occurred
- Apply concepts of adult learning
- Restrict educational content to three or four messages per hour
- Use pairs to help learners differentiate between symptoms and concepts
- Help the learner problem solve by defining problems and listing possible solutions
- Recognize the learner's need to repeat new information in order to move it from short- to long-term memory
- Recognize that repetition is an important method of reinforcing learning
- Recognize that information memorized is easiest to forget
- Use questions to evaluate the learning process and guide the learner
- Evaluate the effectiveness of learning by tracking outcomes
- Understand that retraining or additional education may be required over time

In teaching procedures the instructor will:

- Understand the difference between learning motor skills and procedures
- Not teach theory during motor skill learning
- Demonstrate steps of procedures with consistency
- Prevent the learner from practicing procedures until all steps have been learned in order
- Supervise the practice of procedures until all steps have been mastered
- Encourage and support the learner through repetition and verbal clues
- Provide immediate feedback during practice

Source: Adapted from [138] with permission.

Table 13.12 Suggested content for the PD home training education program

- Review of normal kidney function
- How peritoneal dialysis works
- Principles of aseptic technique
- Preparation of home environment for peritoneal dialysis
- Handwashing technique
- Utilization of waterless hand sanitizer
- Preparation of exchange area
- Organization of supplies
- How to do CAPD exchange
- Problem solving with exchange procedure
- How to set up and program automatic cycler
- Problem solving with cycler/APD procedures
- Addition of medications to PD solution bags
- Warming of dialysis solutions
- Appropriate use of face mask
- Documentation on home record sheets
- Monitoring of weight, blood pressure, and heart rate
- Principles of fluid balance
- Recognition of hypovolemia and hypervolemia
- Guidelines for managing fluid balance
- Exit site care
  - Routine exit site care
  - Use of antibiotic cream/ointment at exit site
  - Recognition of signs/symptoms of exit site infection
  - Care of the infected exit site
- Methods of securing catheter
- Recognitions of signs/symptoms of peritonitis
- Specific instructions related to PD complications:
  - Obstruction to flow of dialysis solutions
  - Change in dialysate color

Table 13.12 (continued)

- Fibrin formation
- Utilization of heparin or non heparin alternatives
- Accidental disconnections
- Traumatic injury to catheter or exit site
- Reporting falls or accidents with suspected abdominal trauma

- Guidelines for utilization of different dextrose concentrations
- Development of individualized daily dialysis prescription
- Daily hygiene routine including showering and frequent handwashing
- Review of medications
- Sexuality and reproductive concerns
- How to contact nephrologist and peritoneal dialysis nurse
- Seeking emergency assistance
- Description of elective or emergent hospitalizations
- PET and adequacy monitoring procedures
- Storage and ordering of supplies
- Review of travel procedures
- Outline of follow-up appointments

The PD unit is typically the site for training; however, in special circumstances, the training may occur in a hospital, rehabilitation setting, or even in the patient's home [146–148]. A few programs have routinely trained patients in their homes; others have limited training in the home to patients with special needs. The patient who is unusually anxious, disabled, or dependent on others for care may benefit from exclusive training in the home [149]. Patient education outside of the dialysis unit typically requires more nursing time, so is costly [149]. Regardless of the site, it is essential to maintain a quiet environment with few interruptions.

Patients may be taught in a small group for at least part of their training. There is no evidence that this method is more or less effective than individual teaching sessions. Some patients find group training supportive; however, others find it too distracting.

Sample content for a PD education program is listed in Table 13.12. This is not all-inclusive, but provides a basic framework. The PD nurse will need to individualize the content for each patient and determine what should be accomplished in each session. Clear, consistent instructions are particularly important when teaching procedures and may foster patient adherence.

The number of training sessions will vary depending on the patient's learning needs and ability to learn; however, the number of patient education days or sessions may be limited by the reimbursement structure, and the nurse must be aware of the financial implications. One study found that older patients and those with more co-morbidity required more training sessions [150].

Patient education needs to be well-documented [151]. Although checklists are useful tools during the patient education process, most regulatory agencies do not consider a checklist alone to provide adequate documentation. A written narrative indicating not only what topics have been covered, but the patient's response may be required. This might include a description of the patient's ability to grasp concepts, remember sequences, perform procedures, and problem solve. Written quizzes or tests may be included as documentation of learning [152].

The patient preparing for home dialysis should also have sessions with both the dietitian and social worker. The dietitian will perform an initial assessment, outline both short- and long-term plans for adequate nutritional intake, and teach the patient and family about the dietary recommendations. Dietary counseling will need to be provided on a regular basis to help the patient maintain an adequate protein intake, control total caloric intake, and avoid excessive intake of phosphorus, sodium, and potassium [7, 153].

The social worker also performs an initial assessment and may assist the patient with community resources, billing issues, supplemental insurance, housing, and transportation issues [154]. The social worker may also help the patient to cope with CKD and dialysis therapy by discussing the patient's fears, anxieties, coping strategies, and support systems. Unusually anxious patients and those with mental health diagnoses will need more intensive psychosocial or psychiatric support during the initial training period or even throughout the course of home dialysis.

The learning process continues after the patient is dialyzing successfully at home [155]; therefore, patient education is never completed, but is a continual process of reinforcement and evaluation of the patient's adaptation and changing learning needs. Some programs have a formal continuing education program, which provides a review and updates for established home dialysis patients [156]. Others have a monthly education topic that is presented at routine clinic visits. Still others provide information on clinic bulletin boards or in newsletters.

Home Visits

Visiting PD patients in their homes may be done at the time the patient completes home training, after the patient is established at home, when dialysis-related problems occur (e.g., repeated infections, problems with fluid balance), or for follow-up of ongoing problems [157–159]. In some programs the home visit is an essential step in initiating PD at home. When the initial home visit is made at the completion of home training or shortly thereafter, it gives the nurse another chance to evaluation evaluate what the patient has learned and the readiness of the patient and family to assume the responsibility for home dialysis.

If necessary, additional education can be provided during the home visit. The home visit provides a critical opportunity to evaluate the patient's environment: where PD will take place, how supplies are stored, facilities for showering or bathing and handwashing, and the safety of the physical environment. The nurse can also observe the patient performing dialysis procedures and interacting with family members and others. Also, in the safety of his or her home, the patient may voice concerns, anxieties, or questions that were not discussed in the dialysis unit. Table 13.13 is a sample checklist for documentation of home visit activities and assessments.

Reinforcement of previous training and additional training of family members may also be accomplished at this visit. Other home health providers may also want to be included at this visit not only to acquire education but also to network with the home PD nurse.

The home visit can enhance the relationship between the nurse and patient, fostering a mutual respect. In response to a patient satisfaction questionnaire, both patients and caregivers responded that they valued home visits [160].

Table 13.13 Home visit assessments and documentation

Physical environment:
____home _____apartment _____nursing home
____shelter _____other
Bathroom facility _____private _____shared

Inspection of environment:

- Cleanliness _____hand soap/sanitizer available
  _____sink/water for hand washing
  _____overall cleanliness of home
- Supplies _____safely stored
  _____missing supplies
  _____inventory list
  _____appropriate quantity
- Medications _____safely stored
  _____refrigerated if needed
  _____location of syringes

Pets

- Type and number of pets
- Are pets restricted from the exchange area?

Designated area for exchanges:

- Are supplies organized for this area?
- Can patient safely do the exchange?
- Can the patient perform handwashing in this area?

Family involvement:

- Who are the significant others in the home setting?
- Are there small children in the home?
- Which family members participate in PD?
- If patient not able to do self-dialysis, who is the dialysis caregiver?
- Does the patient have a health care/medical proxy?
- Who is the emergency contact?

Note date of next supply order and delivery

Schedule follow-up appointments

The limitations of the home visit must be addressed as well. Home visits are time consuming and costly. There may be neighborhoods and physical environments that are not safe for visiting care providers. Also, patients may decline to participate in this activity.

The home visit may need to be repeated if the nurse suspects changes in the home environment that may contribute to increased incidence of infections, patterns of nonadherence, or changes in the family support system.

Observations of the home environment must all be documented in the patient's medical record [157–159]. A documentation tool that follows the unit-specific home visit outline could be developed (Table 13.13).

Long-Term Management

After training has been completed and home dialysis has successfully been initiated, there must be an organized approach to providing long-term nursing care. This includes routine clinic visits, additional visits for problems, telephone follow-up, periodic retraining, and coordination of care with other providers. Table 13.14 summarizes elements of follow-up care for home dialysis patients.

Routine Clinic Visits

Routine clinic visits (e.g., at monthly intervals) provide an opportunity for the team to evaluate the patient's clinical status and adjustment to home dialysis. Ideally, the patient is seen by the PD nurse and the nephrologist together; however, in some programs, the visit with the nephrologist takes place at a separate location. Also, the social worker and dietitian see the patient during clinic visits, either routinely, at intervals as indicated by regulations, or when there is a need or patient request. Elements of the clinic visit are summarized in Table 13.15, and include a physical assessment, review of the current dialysis regimen and medication prescriptions, evaluation of adherence, answering patient questions, providing encouragement and support to the patient and family, and outlining changes in interventions to improve care. All prescription changes and recommended interventions should be documented in the patient's medical record, and the patient should receive a written copy of the team's recommendations [105, 112, 161].

Detecting nonadherence to the plan of care in the home peritoneal dialysis setting is a complex process [113]. The patient is not routinely assessed or observed in the home environment. Unexplained clinical changes in serum chemistries, hemodynamic instability, signs and symptoms of uremia, repetitive infections, and frequent appointment cancellations may be indicators of nonadherence.

Compliance with home peritoneal dialysis has been studied by repeated inventories of home dialysis supplies [162, 163] and by reviewing treatment data recorded by dialysis cycler software [164, 165]. The studies that inventoried home dialysis supplies, one in the United States [162] and one in Brazil [163], found similar rates of compliance with dialysis exchanges: 74 and 70%, respectively. The U.S. study found that noncompliant patients had significantly more peritonitis and hospital admissions, significantly lower weekly Kt/Vs, and were significantly more likely to transfer to hemodialysis [162]. The Brazilian study also found that noncompliant patients had lower weekly Kt/Vs; however, the peritonitis rates were similar between compliant and noncompliant patients [163]. The studies of compliance as recorded by cycler software show relatively few missed treatments, but also measured compliance by the volume of dialysis solution delivered [165] and the total dialysis time [164]. One of these studies found that patient education improved compliance [165]; however, compliance may also have improved in this group because they knew compliance was being monitored.

Establishing a realistic home dialysis regimen that reflects the patient's culture, lifestyle, and psychosocial needs, and providing individualized support may also enhance adherence to the dialysis prescription. This continuum of education and support is essential to foster adherence, not only to the dialysis regimen, but to medications, and to diet and fluid restrictions. Finally, promoting patient adherence to the plan of care is the responsibility of all participating healthcare providers.

The patient who has difficulty adhering to the plan of care or who is experiencing clinical complications may benefit from more frequent visits. One group found that when patients were included in the discussion regarding dialysis prescriptions, they were more adherent to dietary salt and fluid restrictions and had better fluid balance [166].

13.14 Nursing care activities for PD home patients

Establish care plan including nursing diagnoses and associated short- and long-term goals

- Care plan is updated quarterly by the peritoneal dialysis nurse, nephrologist, social worker, and dietitian.
- Document follow-up of home dialysis patient in the clinic visit and telephone consultation notes.
- Recently hospitalized patients will have a discharge summary of care in the medical record coupled with a plan to resume home dialysis care.

Clinical management parameters for home peritoneal dialysis care include

- Hemodynamic stability
  - Assess fluid and electrolyte balance
  - Monitor blood pressure and review blood pressure control
  - Review antihypertensive medications
  - Adjust dialysis regimen as necessary
- Anemia therapy
  - Therapy with erythrocyte stimulating agents (ESAs) is initiated and monitored with appropriate patient education
  - Oral iron supplements and intravenous iron therapy, as indicated
  - Obtain and monitor associated laboratory tests
  - Obtain appropriate insurance authorizations
- Calcium and phosphorus balance; secondary hyperparathyroidism
  - Coordinate nutritional counseling
  - Monitor and adjust phosphorus binders and should be vitamin D therapy
  - Obtain and monitor associated laboratory tests
- Nutrition counseling
  - Coordinate periodic nutritional counseling for patient and family
  - Nursing support for the individualized nutritional plan
  - Refer for resources for nutritional supplements, if needed
  - Obtain and monitor associated laboratory tests
- Catheter management
  - Assess catheter and exit site
  - Review procedures for exit site care
  - Local care interventions when indicated
  - Prescribe/provide antibiotics, when necessary
  - Monitor catheter function
- Home peritoneal dialysis management
  - Monitor patient (and partner's) adjustment to self-care and home dialysis
  - Measure adequacy of dialysis per program policy
  - Explain laboratory and adequacy of dialysis test results to patient
  - Explain need for prescription changes and new dialysis orders
  - Provide option of home visit, if indicated
  - Provide periodic retraining, if indicated
- Development of patient competence and self-responsibility
  - Use team problem solving approach
  - Incorporate patient into decision making
  - Provide time for patient to discuss individual issues with team
  - Individualize patient care and support
  - Offer patient positive feedback on a routine basis
  - Evaluate patient adherence and strategies for accountability
  - Refer for psychological or psychiatric support when indicated
- Transplant evaluation
  - Support transplant education
  - Encourage/refer for transplant evaluation
  - Obtain blood samples for routine screening
  - Encourage patient-to-patient networking
  - Support development of self-care management behaviors
  - Document patient's adherence to self-care management

Table 13.15 Components of clinic visit assessment

Review current dialysis prescription and routine
Reinforce any changes in dialysis prescription
Inspect and evaluation catheter and exit site
Vital signs (including supine and upright blood pressure measurements), and weight
Assess fluid balance
Review prescribed and over-the-counter medications
Assessments including: • Cardiovascular system • Pulmonary system • Gastrointestinal system • Central nervous system • Skin integrity • Mobility/physical limitations • Social support system • Psychological adjustment • Any infections and treatment
Review patient's home records • Dialysis • Fluid balance • Blood glucose control
Review laboratory results
Query regarding any hospitalizations and results of visits to other healthcare providers since last clinic visit
Update nursing diagnoses and care plan as indicated
Schedule follow-up appointment(s)

Communication Between Visits

An important part of follow-up management is communicating with the patient between visits, by telephone, mail, or email. Some programs specify an interval for routine telephone calls for established PD patients (e.g., weekly or once between clinic visits). The frequency and length of these communications also depend on individual circumstances. More frequent communication and more intensive support are required for new PD patients. Communication between clinic visits may also be indicated when a patient has several co-morbid conditions or is acutely ill, when there are problems with adherence to the dialysis routine, and when there are laboratory results that require adjustments in medications or dialysis prescription. Telephone conversations also provide time for the nurse answer questions, provide instructions (e.g., for adequacy collections), and clarify future appointments. Communications between clinic visits a can strengthen the bond between nurse and patient and may help to prevent patient isolation and burnout.

The health assessment and plan of care need to be periodically updated. In some programs or states, monthly or quarterly care plans are mandated.

It is important to engender an atmosphere of trust and security. Developing a supportive environment encourages patients to be honest and open in their communications, to give accurate information about self-care activities, and to voice their questions and fears. Using several avenues of communication with both patients and families encourages active participation. Individual discussion, group meetings, follow-up phone calls, letters, posters, handouts, newsletters, and email are all effective methods of communication.

Retraining

Annual or more frequent retraining sessions are used to reinforce correct dialysis procedures and technique or to introduce new dialysis systems or procedures. Annual retraining can be incorporated into a monthly clinic visit or can be done with a group of patients in classes or a day-long PD patient education seminar. Topics that are frequently covered include review of dialysis procedures, introduction of a new system for CAPD exchanges or a new cycling device, addition of medications to the dialysis solution, strategies to prevent infection, maintaining good fluid balance, recognition of signs and symptoms of infection, basic problem solving, exit site and catheter care, and assessment of the

catheter exit site. Time can also be designated to review how to contact the PD nurse and/or nephrologist for questions, problems, or emergencies, and how to prepare for an elective or emergent hospitalization. Obviously, this list is not all inclusive, but it addresses elements that are critical to safe and effective home dialysis. If a retraining visit is scheduled to address a specific problem, the objectives and strategies for the retraining session will have to be individualized.

Methods of retraining include formal and informal presentations, written handouts, demonstrations, skits, and videos. Methods of assessment include verbal review, quizzes or having the patient fill out a written questionnaire [103, 105, 138, 167]. It is also critical to allow sufficient time for patient and family questions. If the review is done as a class or education day, there should be time for patients to meet and talk with one another. Also, a patient or patients may participate in the presentations. Patients can share helpful hints and strategies for long-term success on home dialysis [168]. As with other types of follow-up care, retraining can contribute to enhanced adherence, and help to prevent burnout.

This time also provides an opportunity to ask the patient and family for suggestions regarding improvement of services and the plan of care. The patient who experiences frequent infections or is having difficulty adhering to home procedures may need frequent retraining that should be focused on the individual patient needs.

Providing On-Call Coverage

In many programs the PD nurse provides "on-call" coverage. Providing this coverage reduces unnecessary emergency department visits and hospitalization admissions, and ensures a channel of communication for the patient on a 24-h basis. This support service is both emotionally reassuring and clinically correct for the home PD patient.

Depending on the particular program's policies, the "on-call" role may vary. The nurse may provide telephone consultation on a 24-h basis to answer patient's questions, assist with problem solving, and offer clinical direction and support. In other situations the nurse is also the provider who triages the patient's care by directing the patient to a physician or emergency department for appropriate care. The most common problem necessitating emergency department visits is peritonitis [169]. In some programs, for a dialysis-related complication such as peritonitis, the PD nurse may also meet the patient at the emergency department to facilitate care.

Other healthcare providers who may be involved in "on-call" coverage include nephrologists, clinical nephrology fellows, interns, and residents. Nurse practitioners and hemodialysis nurses may provide on-call services to PD patients. Standing medical orders and specific policies and protocols to manage clinical problems help to ensure that the care provided is safe and appropriate.

The Hospitalized PD Patient

The role of the home PD nurse in providing care or consultation for the hospitalized patient will vary with each program [170, 171]. The PD program that is either hospital based or hospital affiliated may routinely require direct involvement of the PD nurse. The outpatient PD nurse may provide periodic inservice education for hospital nurses and be responsible for written protocols and guidelines. The PD nurse would be available to direct clinical care of the PD patient in both acute and non acute care units. In other programs, the PD nurse may perform CAPD procedures or set up the cycler and initiate PD. Communication and consistency are vital when providing the direction necessary for safe patient care.

The PD nurse who is not involved in hospital consultation can still participate in providing support for the hospitalized patient. Educating the patient about how to prepare for an elective hospitalization can be incorporated into the initial training for home dialysis. Providing written transfer information for the hospital unit can be critical in assisting the hospital staff to safely provide PD (Table 13.16) [170]. Telephone calls to the patient's hospital unit and primary nurse can be a successful method of clinical support.

Anticipating the patient's needs for an elective admission is another nursing responsibility. Preparing the patient and family for the routine of hospital care can diminish the stress associated with any hospital admission.

When the patient is admitted to a hospital that is not affiliated with a PD program, discussing the patient's dialysis-related needs with the hospital's admitting service and the department of nursing can only help to make the experience safer.

Common issues the PD nurse encounters during hospitalizations are the need for appropriate supplies, identifying who will be responsible for the dialysis exchanges, problem solving with exchanges, prevention of infection, identification of dialysis-related complications, and documentation of the patient's dialysis routine and clinical outcomes. The

Table 13.16 Hospital transfer information for the PD patient

Pertinent medical history/reason for admission
Medication allergies
Other allergies, e.g., latex
Medication list
Peritoneal dialysis
○ Description of any dialysis-related problems
○ Type of catheter
○ Most recent exit site assessment
○ Membrane classification, e.g., PET results
○ Current dialysis prescription
○ Type of PD system or cycler used at home
○ Whether patient requires a partner to do dialysis
○ Most recent dialysis adequacy results
○ Target weight
○ Blood pressure range
○ Specific issues related to home dialysis that may affect discharge

PD nurse may also assist the staff nurses with accurate documentation of fluid balance, the infusion and draining of exchanges and consistent daily weights. Hospital nurses who are inexperienced with PD and CKD particularly need the support of the home PD nurse.

Often, attending physicians or hospitalist physicians are not familiar with the patient's dialysis routine and prescription. Providing a checklist or sample dialysis prescriptions can often improve the appropriateness of the dialysis prescription and diminish the anxiety of the physician who is not familiar with PD. A sample checklist of components of the PD prescription for the hospitalized patient is shown in Table 13.17.

Discharge planning needs to be coordinated between the hospital staff and the PD nurse. The discharge summary of care must be provided to the home dialysis program so that home care can be resumed safely. The list of discharge medications needs to be reviewed carefully by the PD nurse for new medications, intentional changes to the dialysis orders and accidental omissions.

The PD nurse should educate the patient to always call the home dialysis program the day before (or the day of) discharge to arrange for the next outpatient appointment, clarify the current home dialysis prescription, and determine if any additional supplies need to be ordered . In some instances, a visiting nurse may be utilized for nondialysis support. The visiting nurse may not be familiar with PD and may need education about the patient's home dialysis responsibilities.

PD in Long-Term Care Facilities

After a hospitalization or due to other clinical and psychosocial circumstances, the PD patient may not be able to perform home dialysis unassisted. The patient may then need either short-term or long-term care in order to continue PD safely and consistently. Or a rehabilitation facility may provide a bridge before to discharge to the home. If the patient requires rehabilitation, the PD nurse will need to network with the hospital case manager and staff of the rehabilitation facility to ensure that the rehabilitation staff can perform dialysis safely. The rehabilitation nursing staff will need educational programs, written procedures, and protocols to provide PD care and contact information for the PD unit or primary nurse. Weekly or more frequent communication with the rehabilitation facility will provide an opportunity to follow the patient's clinical course and also to consult with the facility staff regarding the PD. Consistent communication is a key to provision of safe dialysis in a rehabilitation facility and also fosters successful discharge planning and transition back to self-care at home.

PD can be provided in the long-term care facility or nursing home as well [172, 173]. The patient may be admitted for a short-term transitional period after hospitalization or may need long-term care. Prior to the patient's admission to the nursing home, the nurse may do preliminary visit to the facility to meet the nursing director, schedule PD education classes for the staff, and to assess the environment for cleanliness and room for supply storage. The nurse will need to provide educational programs, written protocols, and procedures. Specific physician orders for dialysis must be provided and periodically reviewed. Finally, depending upon the state or federal policies and the payers, the administrators of the PD program and the nursing home must develop a written financial contract and clarify billing procedures.

Table 13.17 Dialysis prescription checklist for the hospitalized PD patient

Fill volume

- 500–1,000 mL (new catheter, initial therapy)
- 2,000–3,000 mL (maintenance therapy)
- 3,500 mL or greater (for unusual circumstances)

Exchanges

- Frequency will depend on PET results
- CAPD: 4–5 exchanges per 24 h
- APD: 5–8 exchanges per 24 h (combination of APD cycles, last fill, daytime exchanges)

Dextrose concentration

- 1.5%
- 2.5%
- 4.25%

Icodextrin 7.5% (used for selected patients)

- CAPD: overnight exchange or longest dwell
- APD: longest daytime dwell
- Glucose monitor per manufacturer's recommended list

Heparin

- CAPD: 1,000–2,000 units per 2- or 2.5-L bag
- APD: 2,000–3,000 units per 5- or 6-L bag
- For heparin allergy, heparin alternatives, or tissue plasminogen activator (tPA)

Chronic exit site care

- Daily inspection of site for erythema, exudate, leakage
- Daily cleansing of site
- Application of antibiotic ointments to site if indicated
- Catheter must be secured firmly with tape
- Culture exudate for suspected infection

Antibiotics

- Per current ISPD recommendations and guidelines available at www.ispd.org
- Route may be either intravenous or intraperitoneal
- Dosing may be in each solution bag or in the longest daily dwell

Insulin

- Either subcutaneous or intraperitoneal
- IP should be added immediately before exchange
- Monitor serum blood glucose

Potassium

- Safest route is oral
- May be added to intravenous solutions
- May be added to dialysis solution bag, if necessary

Specimens for suspected peritonitis

- Cell count
- Culture and sensitivity
- Gram stain
- Fungal culture

The monthly clinic visit may be accomplished by transporting the patient to the PD unit or in some situations the PD nurse and nephrologist may elect to visit the patient in the nursing home. This allows for evaluation of the patient's clinical needs and also provides an opportunity to observe the nursing home setting. Care provided by the PD nursing staff must be carefully documented in the patient's medical record in the PD program on a consistent basis.

The PD nurse should also communicate with the family about their perception of the nursing home's ability to safely manage their family member's care.

Modality Transfers

Hemodialysis patients may decide to change their dialysis modality to PD. Unfortunately many patients begin hemodialysis before they are informed about renal replacement options. Some of these patients decide to change modalities when better informed [174, 175]. A hemodialysis patient may also select PD to assume more responsibility for self-care. Hemodialysis patients with vascular access complications may switch to PD due to lack of available access. Often, these patients may have had many attempts to create a vascular access, and a long history of access complications, infections, and hospitalizations. These patients may not have initially selected PD because of reluctance to manage self-care, but now must depend on PD to survive. Such patients are often discouraged, anxious, and without residual renal function. Managing these patients presents a distinct challenge to the entire PD team. Because they have minimal or no residual renal function and often have a history of infection and chronic inflammation, they must be followed closely.

The patient who has a failed kidney transplant may select PD as the modality of choice. This patient may have experienced a very difficult clinical course of rejection episodes, infection, and hospitalizations compounded by disappointment and depression. This patient will also be a challenge to the team due to both the emotional experience of transplant loss and the effects of chronic immunosuppression. The PD nurse will need to pay particularly careful attention to educating the patient about infection prevention.

Assessment and Classification of the Peritoneal Membrane

The policies of the program should include a specific plan for obtaining the first assessment of the dialysis membrane. This will provide information about the patient's individual membrane characteristics that will allow for accurate prescription planning. Recommended assessments include the peritoneal equilibration test (PET), standard peritoneal permeability analysis (SPA), and the peritoneal dialysis capacity test (PDC) [26]. This section focuses on the PET, as it is most widely used. The standardized PET consists of a single 4-h exchange with dialysate samples at 0, 2, and 4 h and a blood sample at 2 h [176–178]. Abbreviated procedures have also been described [179, 180].

It is recommended that the initial PET be scheduled at least 4 weeks after catheter placement and the start of PD. The PD nurse must provide the patient with both verbal and written instructions outlining how to prepare for the test. As the day for the test approaches, it is suggested that the nurse call the patient to review the instructions. On the day of the test, if the nurse suspects that the patient has not complied with the instructions, the PET should then be rescheduled in order to prevent erroneous data and subsequent conclusions. Detailed descriptions of the PET procedure have been previously published [181, 182]. Common errors include inadequate drainage of the prior long-dwell exchange or of the PET exchange; inadequate mixing of dialysate; samples not drawn at the appropriate times; dialysate samples are mixed up and incorrectly labeled; or the final sample is diluted with fresh dialysis solution. If there are problems with the PET or results that are not consistent with the clinical picture, the evaluation can be repeated in the clinic. Each sample should be labeled when drawn (errors can occur with prelabeled tubes), and all samples should be run at the same time.

Indications for repeating the PET are unexplained clinical changes, suspected nonadherence with dialysis, suspected changes in the peritoneal membrane or membrane failure, or if there is an apparent change in membrane function due to infections or surgical procedures. Some programs may choose to repeat the PET at standard intervals, but there is no conclusive evidence that this is necessary.

PD Adequacy

Provision of adequate dialysis is part of the foundation to achieving a successful PD program. The PD program must have policies and procedures to direct an organized approach to the assessment of dialysis adequacy, and to intervene with appropriate dialysis prescription adjustments. Typically, the PD nurse and the medical director collaborate to develop dialysis adequacy policies, procedures, and data collection tools. Careful review of the current evidence-based practice guidelines [24–26] is necessary to determine the standard of practice and set the program's adequacy goals. In some countries, regulatory agencies mandate evaluation of dialysis adequacy at specified intervals to insure the delivery of safe patient care.

Differentiating between the concepts of adequate dialysis and optimal dialysis is important when establishing program policies. Adequate dialysis is defined as the dose of dialysis associated with an acceptable morbidity and mortality. Optimal dialysis is defined as the dose of dialysis associated with no further improvement in symptoms and survival [183, 184].

One typical practice is to schedule the first adequacy testing with the initial PET. An alternate approach is to perform both the first PET and initial adequacy testing during training. Adequacy testing may be repeated according to practice guideline recommendations or specific program policy. Clinical reasons for repeating adequacy testing include diminished residual renal function, symptoms of uremia, evaluation of patient adherence to dialysis prescription, and validation of the effectiveness of major prescription changes [26, 178, 185–188].

Dialysis adequacy testing should always be accompanied by a careful clinical assessment of the patient. An individual who is adequately dialyzed will look well, be free of uremic symptoms, maintain appropriate physical activity, have adequate nutrition, and report a generalized sense of well being [183]. In contrast, the patient who is inadequately dialyzed will have uremic symptoms and difficulties with fluid balance and blood pressure control. Inadequately dialyzed patients may also be malnourished and anemic, and are more likely to have neuropathies and sleep disturbances [183, 187]. Eventually, patients who are not well dialyzed will have an increased incidence of cardiovascular events, hospital admissions, and deaths [189, 190].

Risk factors for inadequate dialysis include an inappropriate or inadequate dialysis prescription, loss of residual renal function, large body surface area, low membrane transport characteristics, poor tolerance of large exchange volumes, a pattern of noncompliance, and patient resistance to prescription changes [187, 188, 191].

Urea kinetic modeling of peritoneal dialysis [192] requires a 24-h collection of urine and dialysate. The adequacy assessment should be done when the patient is clinically stable, does not have an infection, and is in good fluid balance. Patients must receive specific written instructions, verbal explanations, and appropriate reminders to complete the adequacy study. Patients should also be interviewed when they bring in the collections to determine if the samples were collected and labeled appropriately. PD adequacy assessment collection procedures are outlined in Table 13.18 [182, 193, 194].

If working in a hospital-based or independent facility, the PD nurse may need to communicate with laboratory personnel to explain the purpose of adequacy testing and the collection procedures and to agree upon sample size, containers. and labeling.

Common problems with the PD adequacy assessment include patient errors in collection (incomplete drain, including too few or too many exchanges, inaccurate volume measurement), mislabeling of specimens, laboratory errors, and calculation errors. Dialysate collections with either too many or too few exchanges will yield erroneous results and cannot be used. Also, if the patient does not save all urine, or saves urine at a different time than the dialysis, the results will not be accurate. The PD nurse and the laboratory must follow specific written procedures to collect and label samples correctly and analyze the results accurately [181, 186].

The laboratory results may be reported as raw data or may be returned with adequacy calculations. If raw data is reported, the PD nurse may perform the adequacy calculations manually, or enter them into a computer program, which will automatically calculate the adequacy results.

The adequacy results can then facilitate prescription adjustments [4, 183, 184, 187, 188]. Prescriptions that are individualized in respect to the patient's membrane characteristics will be most effective [183, 195]. The patient with low transport rates will benefit from longer dwell times and larger exchange volumes. The patient with average and high average transport rates may need additional exchanges and larger exchange volumes. The patient with a high transport rate will need rapid cycles with an automatic cycler with one or more daytime exchanges [196]. The patient who is experiencing a decline in residual renal function may need adequacy monitoring and prescription adjustments more frequently to avoid inadequate dialysis.

All adequacy assessments and prescription changes need to be carefully documented in the patient's medical record. These data can then utilized by the quality management program focusing on the provision and documentation of adequate dialysis.

In summary, maintaining adequacy is dependent on the information that the membrane characterization and adequacy studies offer. This allows the PD nurse and team to make thoughtful and accurate dialysis prescriptions [178, 183, 188]. Careful explanation to the patient coupled with a positive supportive approach can foster the patient's cooperation with prescription changes and overall adherence [186].

Prevention of Infection

Another cornerstone of successful PD therapy is the prevention and treatment of infections. The PD nurse must be expert in educating the patient about safe home procedures, identification of infections, and the importance of adherence to procedures [184]. The nurse also must be aware of the most current infection guidelines and recommendations concerning the catheter exit site and peritonitis [27, 197–200].

Table 13.18 PD adequacy assessment collection procedures

CAPD batch method

- Collect all drain bags for 24 h
- Weigh/measure effluent to determine 24-h total volume
- Combine all drained effluent in one large container
- Mix well
- Take sample for urea, creatinine

CAPD aliquot method

- Collect all drain bags for 24 h
- Weigh/measure effluent bags individually and calculate total volume, for example:
  #1 2,700 mL
  #2 2,600 mL
  #3 2,750 mL
  #4 2,850 mL
  total 24-h volume: 10,900 mL
- Take 0.1% sample from each bag (the volume of the bag is recorded in mL, and the decimal point is moved three places to the left); for example, 0.1% of 2,700 mL is 2.7
- Combine all samples and send to laboratory for urea and creatinine

APD batch method

- Instruct patient to collect 24-h dialysate in drain bag
- Instruct patient to save drain bag and note treatment data from the APD machine (nighttime prescription volume, initial drain, and UF)
- Patient may bring entire drain bag or instruct patient to mix dialysate and take a sample from the drain bag
- Calculate 24 h drain volume
- Take an appropriate sample and send to laboratory for urea and creatinine

APD aliquot method

- Instruct patient to collect 24-h dialysate in drain bag
- Instruct patient to save the drain bag from the daytime exchange
- Instruct patient to bring 200 cc from the APD drain bag and the entire manual drain bag to the unit
- Instruct patient to note treatment date from APD machine (night time prescription volume, initial drain, and UF)
- Calculate 24 h drain volume from APD and manual exchange
- Agitate drained effluent in bag to mix well
- Take 0.1% sample from APD drain bag; for example, if total APD drain volume is 11,400 mL, 0.1% is 11.4 mL
- For the manual exchange, weigh/measure the dialysate volume
- Take 0.1% sample; for example, if bag volume is 2,600 mL, 0.1% is 2.6 mL
- Add the two samples together in one container and mix well
- Take an appropriate sample and send to the laboratory for creatinine and urea

Source: Adapted from [182] with permission.

The primary goal of exit site care is to prevent infection [27, 132, 201]. Chronic exit site infections lead to prolonged use of antibiotics, disruption in adequate nutrition, and possible catheter removal. A recent study by Hall and colleagues found that the use of a structured education program based on principles of adult learning resulted in improved exit site conditions [137]. The written procedures must be clear, concise, and reinforced at each clinic visit. The nurse must be careful to assess the exit site at each clinic visit, and if an infection is suspected, treatment must start immediately to prevent a tunnel infection that usually leads to catheter loss [202]. There are situations that predispose the patient to early exit site infections. These include *Staphylococcus aureus* nasal carriage, sutures at the exit site, excessive manipulation of a newly implanted catheter, early colonization of the exit site, malnutrition, and diabetes [132, 204]. High-risk patients must be identified and their exit sites must be consistently and carefully assessed [203, 204].

There is a variety of protocols for exit site care [205–208] and currently most recommendations are opinion- rather than evidence-based [27, 132]. However, there is general consensus about many aspects of exit site care [205–208]. The initial dressing(s) should be changed by the PD nurse or designee. The use of aseptic technique, gloves, and masks are commonly noted. Careful hand washing is mandated along with securing the catheter with tape or immobilization devices to prevent traction and disruption of the exit site and tunnel. Effective cleaning of the site can be accomplished with normal saline, hypertonic saline, dermal wound cleansers, or mild soap and water. Hydrogen peroxide and iodine preparations should not be used in the healing wound tissue but could be used on the surrounding skin. Patients are taught to sponge bathe until the site heals, then they can shower. The healing exit site should not be submerged in bath

water. This prevents contamination with water-borne organisms and maceration of the healing tissue in the sinus track [132]. Dressings should be of absorbent material.

Some programs will have the patient remove the dressing once the site is healed or only wear a loosely applied dressing as a means of mechanical protection for the site. Antibiotic creams and ointments may be prescribed for exit site care as well. The most commonly used agent is mupirocin applied in a thin smear to the site daily or less frequently [209]. Recently gentamicin cream has been used with reported success [210].

Treatment of an exit site infection must be prompt and thorough. Erythema, tenderness at the site, and the presence of exudates all indicate the presence of infection [27, 132, 202–204, 209, 210]. The exudate should be cultured when present, because cultures of the exit site and sinus track may grow resident flora, rather than the infecting microorganism. Exuberant granulation tissues should be cauterized with silver nitrate sticks. Local care may include the application of wet saline dressings to the exit site daily or more frequently, cleansing with a mild cleansing agent, and carefully securing the catheter with nonirritating tape [132, 201, 202, 205]. The ISPD has published guidelines for treatment of exit site infections [27] and these are also available online at www.ispd.org. The usual course of antibiotic therapy is a minimum of 2 weeks. Infections that do not resolve, or that recur, and fungal infections will need a longer course of treatment. Inadequately or ineffectively treated exit site infections may progress to tunnel infections, which are often chronic and may result in peritonitis, catheter loss and transfer to hemodialysis [27, 202].

Each program must develop as specific set of policies and procedures to prevent, identify, and treat peritonitis. These must be periodically reviewed with the team to assure awareness of and support for the policies. Effective patient education must be a part of peritonitis prevention and management. The success of patient education will depend on the education of the PD nurse. The nurse must know how peritonitis is defined (Table 13.19) and the routes by which it can be acquired (Table 13.20) [27, 211]. Most nurses will have completed a basic microbiology course, but the PD nurse must assume responsibility for the specific knowledge needed to classify causative organisms, understand antibiotic treatment, and provide appropriate follow-up. The PD nurse must be familiar with the latest protocols and guidelines (from the ISPD, current literature and from national and regional conferences). Protocols can be obtained from the ISPD website. Networking with colleagues can also help with anecdotal experiences. The medical director must support the PD staff in assessment of infected patients, provision of peritonitis treatment and follow-up.

Identifying the risk factors for peritonitis can guide the nurse in the routine monthly clinic assessment. These include chronic exit site infection, tunnel infection, nasal carriage of *S. aureus*, bacteremia, immunosuppression, history of hemodialysis access sepsis, poor adherence to dialysis procedures, and invasive procedures not covered with prophylactic antibiotics (e.g., dental work, colonoscopy, and biopsy). CAPD systems that require spiking bags are associated with higher peritonitis rates than double-bag systems.

The presentation of peritonitis is noted by cloudy fluid, tenderness of abdominal wall, pain, fever, chills, diarrhea, nausea, and vomiting. Collecting the specimens is very important to identify the organism in a timely way. Each program must have a specific strategy for specimen collection, laboratory cooperation, and retrieval of results.

Table 13.19 ISPD peritonitis definitions [27]

Peritonitis – inflammation of the peritoneum
Infectious peritonitis – inflammation of the peritoneum due to microorganisms
Refractory peritonitis – symptoms persist after 5 days of treatment
Relapsing peritonitis – infection recurs within 4 weeks of therapy completion with same organism
Recurrent peritonitis – infection that recurs within 4 weeks of therapy completion with a different organism
Re-infection peritonitis – infection that occurs more than 4 weeks after therapy completion with the same organism
Nosocomial peritonitis – infection that occurs during a patient hospitalization

Table 13.20 Routes of contamination responsible for peritonitis [27, 211]

Transluminal – contamination of the closed system
Periluminal – along the outer surface of the catheter
Hematogenous – blood-borne organisms
Transmural – migration of organisms from the bowel
Ascending – from the female reproductive tract

Table 13.21 Determining the time at risk for infection

Time at risk (in days) =
patients on PD for entire month × # days in month
Plus
days of PD for new patients who trained, transferred in or returned post-transplant
Plus
days on PD for patients who discontinued PD due to transplant, transfer or death
Total days at risk ÷ number of days in month = months at risk
Months at risk ÷ 12 = years at risk
Number of events ÷ years at risk = rate per year
To determine the interval of months between episodes:
Months at risk ÷ episodes
Months between episodes ÷ 12 = rate per year

Source: Modified from [58] with permission.

Part of the initial training time must be devoted to the prevention and treatment of infection. The PD nurse must work very closely with each patient to assess individual risk factors, personal hygiene, procedure technique and potential for adherence. The patient should be provided with instructions for accidental contamination and also what to do if symptoms of peritonitis occur. Infection prevention must be reviewed periodically, at the home visit, at a monthly clinic visit or during retraining. The patient's vision and fine motor control should be periodically evaluated. Multiple infections or suspected changes in the home environment may prompt an additional home visit [159].

Once the diagnosis of peritonitis is made, the nurse must insure that the specimens are collected correctly and antibiotic treatment is started. Antibiotics may be given by the intravenous, intraperitoneal or oral route. The current ISPD guidelines and recommendations provide extensive information for antibiotic treatment [27]. The patient may come to the clinic to receive treatment, but is typically taught to self-administer at home. Fluid balance and protein intake will need to be carefully monitored during this period of acute inflammation. If the patient is too ill to manage safely at home, hospitalization may be necessary.

It is important to discuss with the patient what may have contributed to the development of peritonitis, but at the same time it is important not to blame the patient. Supporting the patient during the infection is crucial to promote future adherence and to alleviate the patient of guilt and uncertainty [112, 113].

The evaluation of peritonitis must be part of the quality management program. Each infection must be documented along with the results of treatment. The PD nursing staff must participate in quality projects related to infection and are often responsible for determining the program's rates of exit site infection and peritonitis. Table 13.21 outlines one method of determining time at risk for infections [58], one of the steps in determining infection rates. This infection documentation should be done monthly and then collated yearly. The data and analysis is necessary to evaluate the program's management of infection.

Special Considerations

Employment

Working, either full time or part time, is important for many PD patients. Some patients choose PD therapy because it provides the flexibility of scheduling that enables them to continue working. Also, the sense of accomplishment and purpose, and the income attained by working contribute to the well being of the home dialysis patient. Vocational counseling by the social worker or by a specialized counselor can be helpful to the patient seeking employment.

For the patient who is already employed, the PD nurse and patient can adjust the home dialysis schedule to accommodate the work schedule. Flexibility and creative planning may be necessary. Rearranging supply deliveries, clinic visits, and timing of exchanges may help the patient to sustain employment and to also be adherent with the dialysis schedule. If the patient is able to do an exchange in the workplace, the PD nurse may, at the patient's request, make a visit the workplace to inspect the environment where the PD exchange will take place and offer suggestions and support to the patient. Also, if the patient requests, letters may be sent to the employer to describe the dialysis regimen and provide education for the employer. The PD nurse should monitor the patient's adjustment to work, ability to do dialysis safely in the work setting, and to maintain an acceptable dialysis routine [8].

Exercise

Routine exercise is important to maintain cardiovascular health. The nephrologist and PD nurse must assess the patient's capacity for exercise and make recommendations regarding how to exercise safely. In all cases, the exercise program must be individualized. Care must be taken not to put pressure or traction on the PD catheter. It is important that the integrity of a healed tunnel remain intact in order to prevent exit site infection and dialysate leaks. Low impact exercises that avoid high intraabdominal pressure, such as walking and the use of a treadmill device at low speed and minimal platform elevation, or riding an exercise bicycle with minimal resistance [212–214] are safe for the majority of PD patients. Sports that involve physical contact, jumping, and weight lifting are riskier and need to be carefully evaluated. In all instances, the nephrologist must be involved in this assessment and the plan for the patient needs to be documented.

Warming Dialysis Solutions

Dialysis solutions should be protected against extremely hot temperatures during shipping and storage. High temperatures cause the glucose to break down, forming glucose degradation products (GDPs). The level of cytotoxic GDPs can double within a few hours; however, the concentration of GDPs gradually returns to normal when the dialysis solution temperature is lowered, and returns to baseline within 40 days [215].

Dialysis solutions should be warmed to body temperature shortly before use. Most manufacturers recommend using dry heat with temperature regulation to provide a safe heating mechanism for the home PD patient. Often a heating pad device is used; this is included in the initial home supply shipment. Other commercially available devices that employ dry, temperature-regulated heat (e.g., a heating cabinet or incubator) may be used in the dialysis unit or purchased by patients. Home patients have warmed bags by placing them in the sunshine or on a home heating vent or radiator. Regardless of the warming mechanism, the temperature of the solution should be approximately 37°C, and the bags should feel tepid to the touch. Heating solution bags in warm water is not recommended due to the potential exposure to water-borne organisms. If necessary, a dialysis solution bag that is at room temperature can be infused slowly to avoid excessive abdominal cramping.

Microwaving PD solution bags is controversial. Microwave devices may heat solutions unevenly, creating hot spots that may not be noticeable to the touch. This then exposes the patient to the risk of thermal burns. Also, due to differences in wattage and efficiency, different microwave ovens will require different time settings to achieve the same final temperature. Although microwaving PD solutions does not alter the pH or chemistries of the solution [216, 217], it is less clear whether microwaving PD solution bags causes leaching of plasticizers and chemicals into the dialysis solution.

Although manufacturers may not recommend microwaving their PD solutions, this has been widely practiced. Each program must make an informed decision whether it will allow microwave warming of PD solutions. Specific policies and procedures for microwaving PD solutions must be developed. Overheating of solutions can be avoided by measuring the warming time required for each size bag to reach 37°C in each microwave used to warm solutions. Inverting the heated bag several times will mix the solution and help to dissipate hot spots [177, 216].

Swimming

There are a number of anecdotal opinions regarding the risks and benefits of swimming for PD patients; however, many agree that swimming is an acceptable form of exercise for the PD patient. The patient with an exit site that has not healed or is infected should avoid swimming until healing has occurred [8, 201, 214]. The patient who has a healed exit site may swim but will need to protect and care for the exit site per program procedures. There are a variety of recommendations to consider. Some programs advocate covering the exit site and catheter with occlusive dressings while swimming, and then performing exit site care immediately after swimming. Others recommend changing into a dry bathing suit or clothing after swimming to prevent prolonged moisture at the exit site. There is more consensus that swimming in lakes and ponds poses the greatest risk for infection due to stagnant water with high bacteria counts. There is also general consensus that swimming in clean, chlorinated pools poses the least risk, and that the risks associated with swimming in ocean waters depends on the proximity of the beach to sewage outlets and highly populated areas [8, 214].

Table 13.22 Checklist for patient traveling on peritoneal dialysis

Travel details
Destination
Travel dates
Mode of transportation
Type of lodging
Back-up PD unit
-Unit name
-Individual contact name
-Contact information
-Billing policy
-Required diagnostic tests
-Required medical records
Shipping of dialysis supplies
Patient education
Letter of medical necessity
Supplies and equipment to carry on
Medications
Diabetic supplies
Performing dialysis procedures while traveling
Traveling with a cycler
Disposal of dialysate
Contacting the back-up unit
Paying for dialysis expenses while traveling
Tips for international travel

Source: Abstracted from [220] with permission.

Travel

PD patients may travel for pleasure or business; regional, national, and international travel can all be accomplished while performing PD safely; however, the dialysis unit must assist the patient in preparing for dialysis while traveling [218–226]. A detailed resource for both the nurse and PD patient is the "PD Tool Box" [220]. Information abstracted from this reference is included in Table 13.22.

When making travel plans, the patient needs to inform the PD nurse of the destination, and dates of departure and return. A dialysis unit at the patient's point of destination must be identified as an emergency contact for short trips; however, the designated unit may assume the role of the primary dialysis unit during a prolonged stay.

The patient should travel with letters of medical necessity, a description of medical supplies, a list of medications, copies of the current information from the medical record (similar to the information for hospital admission, Table 13.16), and the telephone numbers of emergency contacts and the destination dialysis unit.

Often, dialysis supplies are delivered to the travel destination. Arrangements with the home dialysis supplier must be made well in advance to prevent disruption of service and additional charges. All administrative and financial details must be reconciled before the patient arrives at his destination. Dialysis services provided in other countries may not be covered by health insurances and may require private payment by the patient.

If the patient is traveling to a remote area and is not able to reach a dialysis unit in a reasonable amount of time, a supply of antibiotics may be given to the patient to self administer in an emergency situation.

Disaster Preparation

Recently, we have witnessed natural disasters that have included hurricanes, tornados, earthquakes, tsunamis, fires, and extreme temperature changes. Political and religious tensions have resulted in conflicts and terrorist attacks. These events have raised awareness of the potential for future disasters and the necessity of disaster planning. The PD nurse must help the patient and family prepare to continue dialysis during a disaster, when there may be disruption in communications and dialysis-related services [227–229], but must do so without unnecessarily alarming them.

Patients who use a dialysis cycler should be taught to use manual systems in case of power outages, or should have a back-up generator to provide temporary power. Home dialysis patients should have a minimum of 2 weeks of PD

supplies and all medications. Waterless hand sanitizers should be kept on hand in case of contaminated water supply. Patients should also be encouraged to have several days of food and bottled water on hand in case of interruption in basic services. Each patient should have a current medication list, a medical alert bracelet, and a plan of how to communicate with the home dialysis unit [230].

A discussion about how long the patient can survive without dialysis may also be necessary along with an emergency diet list and strategy for fluid management. In a prolonged or widespread disaster, the patient may need to seek treatment at a distant dialysis unit or hospital. Each patient should have a list of emergency phone numbers and a list of alternative dialysis units and hospitals. Patients may be referred to the National Kidney Foundation, the regional ESRD Networks, and the Centers for Disease Control and Prevention for additional brochures and dialysis preparedness information [231–233].

Roles of the PD Nurse

The success of individual PD patients, the success of dialysis programs, and the success of PD as a renal replacement modality all depend on contributions of the PD nurse. The combination of roles of the PD nurse is perhaps among the most unique in the profession of nursing. The PD nurse is influential in providing home dialysis care and is often viewed as the team leader for this modality [12, 13]. Balancing nursing autonomy with the multidisciplinary team effort required can provide both professional and personal satisfaction. To achieve this, the PD nurse must integrate a number of varied roles on a daily basis. Each of these roles is important for successful outcomes.

The first role is that of an educator. Providing consistent and creative patient education is the foundation of a successful PD program [8, 142, 234]. Although healthcare professionals do not necessarily receive formal courses in adult education, it is imperative that the PD nurse acquire the knowledge and skills necessary to teach patients and families. This knowledge may come from formal education courses, continuing education, review of the education literature, and information from other colleagues and through anecdotal experiences [138, 139]. Critical content includes principles and theories of education, the characteristics of the adult learner, and teaching methods [112]. The nurse is also responsible for acquiring or developing patient educational materials and establishment of a specific home training plan. These must then be individualized for each patient with chronic kidney disease who chooses PD therapy.

Although educating patients and families is the primary goal of the PD nurse, educating other healthcare providers is also essential. The nurse will often be responsible for educating others regarding specifics of PD. The target audience may include physicians, renal fellows, nephrology and non-nephrology nurses, advanced practice nurses, dialysis technicians, dietitians, social workers, administrators, and allied healthcare personnel (e.g., secretaries, laboratory technicians, insurance representatives) [138, 234–236]. In providing education to other healthcare professionals and support staff, the PD nurse promotes self-care while also promoting PD as a renal replacement therapy.

The PD nurse is also a learner. Acquisition of information about chronic kidney disease, diabetes mellitus, gerontology, peritoneal dialysis, infections, cardiovascular disease, research findings, practice guidelines, and new regulations is a continual process, which is critical both to develop individual expertise and remain clinically competent.

The next role that the PD nurse must fulfill is that of a clinical care coordinator. The patient and PD nurse work together at the central focus of the home care team [1, 12, 13]. The nurse often coordinates the care provided by the nephrologist(s), social worker, dietitian, access surgeon, transplant team, and other caregivers (Table 13.1). Furthermore, the nurse ensures that appropriate communication is established with the primary care physician, nurse practitioner, and specialty consultants. Functioning as a care coordinator requires persistent attention to detail and maintaining consistent channels of communication. The result of this care coordination is the provision of efficient, safe, and competent patient care with smooth transitions between care settings [237].

The PD nurse also has a strong clinical role, starting with the responsibility for developing safe and effective policies and procedures both for the dialysis clinic and self-care at home. The nurse must have clinical assessment skills, clinical expertise, and critical thinking ability [238] to make accurate nursing diagnoses and identify appropriate nursing interventions for complications of chronic kidney disease, PD, cardiovascular disease, diabetes mellitus, and vascular disease. Also, the application of self-care management principles, fostering adherence, and identifying psychosocial needs [239, 240] are part of the clinician role [113, 134]. Finally, the clinical role includes measurement and documentation of short- and long-term outcomes. These data can be compared against regional and national standards and benchmarks to determine the quality of care [35–39, 241]. They can also be used for specific continuous quality improvement projects.

The PD nurse may also participate in clinical research. Most often nurses assist in identifying eligible patients, and with recruitment and data collection. As PD nurses becomes more experienced with and educated in clinical research techniques, they often assume more responsibilities and may participate in clinical trials and multicenter studies [238]. Eventually, some nurses go on to assume lead roles as research investigators. Nurses should also utilize clinical research findings, developing an evidence-based practice whenever possible.

Mentoring is also a role that the PD nurse must fulfill. It is critical to guide new and less experienced nephrology nurses to encourage professional development [242].

Finally, the PD nurse is a leader [242, 243]. To become a respected professional and leader, there must be a balance among the various roles. A leadership job title does not need to be assigned for the nurse to be respected as a leader. The truly professional PD nurse accepts the autonomy the role provides, but at the same time respects the boundaries of the nursing roles and practices accordingly [244–246]. Daily clinical practice requires competency, commitment and integrity. This commitment fosters a sense of trust that patients recognize and respect. And it is this trust contributes to the unique bond between the PD nurse and patient [112]. The patients recognize that the nurse is a leader who provides not only expert clinical care but also compassionate support. Nephrologists recognize the PD nurse as a collaborative partner in providing safe home dialysis care and value the commitment to pursuing standards of excellence [7, 10, 12, 13, 247–249].

Fulfilling these roles depends on the level of competency the PD nurse achieves. It is crucial for the nurse to broaden his/her scope of knowledge. Understanding the literature, networking with expert colleagues, and attending conferences and national meetings are all part of becoming a competent professional. Joining professional organizations and participating in committees and projects enlarges the nurse's professional experience. In turn, this professional enrichment enhances clinical care [249].

Conclusion

In conclusion, to successfully fulfill these roles, the PD nurse requires a broad knowledge base, many skills, and a measure of courage. The nurse must be willing to function autonomously, take risks, balance multiple challenges, and promote and accept change. Above all, the nurse must have the commitment and courage to champion the PD program.

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