

Disaster Planning for Peritoneal Dialysis Programs

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Because of increased intensity of hurricanes in the Gulf Coast region of the United States, peritoneal dialysis (PD) programs have been disrupted and patients relocated temporarily following these catastrophic events. We describe the disaster planning, implementation, and follow-up that occurred in one such PD program in New Orleans following Hurricane Katrina.

Each year at the beginning of the North American hurricane season, the PD program's disaster plan is reviewed by clinic staff, and copies are distributed to patients. Patients are instructed to assemble a disaster kit and are provided with contact numbers for dialysis suppliers and for a PD program in their planned evacuation city. In July 2005, this disaster plan was tested when an early tropical storm and hurricane entered the Gulf, and several patients briefly relocated or evacuated because of power loss and then returned without incident. However, when Hurricane Katrina, a category 5 storm, was predicted to strike the metropolitan area, patients were notified by telephone to evacuate, and contact information, including their evacuation city and telephone and cellular phone numbers, was obtained. Patients were also reminded to take all medications, bottled water, antibacterial soap, hand sanitizer, and 4 – 5 days of PD supplies.

Following the storm, telephone and cellular phone services were severely disrupted. However, text messaging was available to contact patients to confirm safety and to provide further instructions. Arrangements with the major dialysis suppliers to ship emergency supplies to new locations were made by the PD nurse and the patients. Only 2 of 22 patients required hospitalization because of complications resulting from evacuation failure, contamination, and inability to perform dialysis for a prolonged period of time. Both of these patients were quickly released and have

continued PD. Following the event, all patients remained on PD, and most have planned to return to their home PD program.

Thorough preparation, planning, practice, and implementation and effective communication are necessary to prevent complications in PD patients who are affected by disasters. With advance preparation, maintenance of communication with health care providers, and planning for alternative sites of care, patients can be safely maintained on PD without complications following catastrophic natural disasters.

Key words

Disaster planning, telecommunications, self-management

Introduction

Natural disasters pose great challenges for people with unique health care needs, particularly dialysis patients. In the past decade, increases have been seen in the number and intensity of hurricanes in the southeastern United States and in the incidence of severe rain with flooding or mudslides in the Midwestern and western United States and of earthquakes in earthquake-prone regions worldwide. These natural disasters have resulted in damage to the medical infrastructure and to basic systems for medical care. They can completely prevent patients from receiving dialysis.

With greater awareness of the potential for severe disruption of medical care by natural disasters, disaster planning must become an important part of any health care program (1). Dialysis patients residing in at-risk areas need to utilize the safety plans developed by their medical facilities and personal individual safety plans that are periodically updated and reviewed. When Hurricane Katrina, the worst natural disaster in American history, hit Louisiana and Mississippi on August 29, 2005, it completely disrupted the delivery of health care—and particularly dialysis services—to patients along the entire Gulf Coast. This report describes the successful experience of one home peritoneal dialysis (PD) program,

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Tulane–Dialysis Clinic Inc. (DCI), in preparing for this disaster and caring for patients in its wake.

Event summary

The Tulane–DCI PD program, located in downtown New Orleans adjacent to Tulane University Hospital and Clinic, has 22 patients. Most live in the greater New Orleans area. One home PD nurse supervises care for all patients, and two physicians manage all the cases. Each year at the beginning of the North American hurricane season, the disaster plan for the Tulane–DCI PD program is reviewed by clinic staff, and copies are distributed to all patients during an office visit. Patients are instructed to assemble a disaster kit and to make a disaster plan. They are also provided with contact numbers for dialysis suppliers and for a PD program in their planned evacuation city.

In July 2005, the program's disaster plan was tested when an early tropical storm and hurricane entered the Gulf. Several patients briefly relocated or evacuated because of power loss, and then returned without incident. In August of the same year, Hurricane Katrina became the first category 5 hurricane predicted to strike the New Orleans metropolitan area in 50 years. Evacuation of the entire metropolitan area was recommended. Two days before the storm, DCI patients were notified by telephone to evacuate. Contact information was confirmed, including evacuation city, and patients were reminded to take their disaster kit with approximately 1 week of PD supplies. In addition, patients were provided with the cellular phone number of the PD nurse.

All but 5 of the 22 patients in the PD program evacuated before the storm. However, with the failure of the East Bank levee system, evacuation of the remainder of the metropolitan area occurred within the first week following the hurricane.

Immediately after the storm passed, the PD nurse began contacting patients by cellular phone to determine safety and needs. However, in many of the primary evacuation areas in Louisiana and Mississippi, communication—whether by cellular phone, landline, or e-mail—quickly became extremely difficult because of the loss of electricity, the destruction of many cellular towers, and the inability of cellular networks to handle the volume of voice calls. However, the text-messaging system was not adversely affected by the storm, and it

was used to communicate with patients. The initial message sought to ascertain patient safety and current location.

Interestingly, none of the patients or staff from the PD program had used text-messaging to communicate before the storm. But, in the immediate storm aftermath, text messaging was soon recognized to be the most reliable method of communication. Contact information and details about additional supplies could be communicated only via text messaging as everyone quickly learned.

Patient outcomes

Power failures prevented patients from carrying out continuous cycling PD (CCPD), and lack of a suitable environment prevented other patients from performing adequate continuous ambulatory PD (CAPD).

After the storm, 1 patient was evacuated and hospitalized for volume overload resulting from a lack of dialysis for a 5-day period. This patient lived in one of the remaining dry areas of the West Bank of New Orleans and was not exposed to potentially contaminated floodwater.

Another patient who did not evacuate in advance was rescued from his flooded home and transported to the Ernest N. Morial Convention Center to await evacuation. As a result of exposure to contaminated floodwater, this patient developed peritonitis, which necessitated a short hospital stay for treatment.

A third patient who lived outside of the New Orleans metropolitan area did not evacuate because hurricane-force winds from Katrina were predicted to be significantly less at his home's location. However, Hurricane Rita, which followed 3 weeks later, necessitated his evacuation because of rising floodwaters from the storm surge. This patient continued PD without interruption, experienced no complications, and resumed his usual dialysis schedule and work schedule upon return to his home. As with other patients, adequate self-management prevented complications during this time.

After the initial evacuation, problems caused by the extensive flooding in the aftermath of Katrina prevented patients and the PD program staff from returning to New Orleans for weeks or months. It became impossible to provide ongoing care—such as administration of erythropoietin and monitoring of laboratory values—in conventional ways. The role of the home dialysis nurse in coordinating patient support

became critical, particularly with regard to erythropoietin and supplies.

Approximately one half of the DCI patients received in-center erythropoietin injections; the other half self-administered erythropoietin. All patients had been seen within a month of the storm, and therefore half of the patients had a 1- to 4-week supply of erythropoietin for self-administration. The remaining patients needed to arrange for a back-up unit to continue to provide erythropoietin.

Most patients evacuated with only about 1 week of PD supplies, and therefore arrangements with dialysis suppliers were required to provide emergency PD supplies to the evacuees' locations. In some instances, the dialysis suppliers were called directly by patients, and the suppliers were able to provide updated location information to the PD nurse, particularly when some patients evacuated a second time as a result of Hurricane Rita. Emergency shipments occurred promptly when transportation services resumed.

Socioeconomic status was an important factor in patient evacuation. Many minority and indigent patients lived in the most devastated areas of New Orleans; they experienced nearly complete property loss from wind and flood damage. In these instances, patients were more likely to remain with family in their place of evacuation or to establish new homes in the new locations. When 5 patients made the decision to transfer to another PD program, the PD nurse facilitated these transfers by providing the necessary information by telephone and e-mail.

As a result of the evacuation and closure of all hospitals in New Orleans because of flooding, many hospitals in the surrounding communities that sheltered evacuees and patients were operating at full capacity. Waiting times for emergency visits were prolonged. In an effort to reduce the need for emergency department visits for simple problems, patients were reminded to contact the PD nurse with *any* difficulties. The PD nurse was able to communicate with the physicians and to authorize prescription refills and develop standing orders for common problems, with additional criteria for immediate emergency evaluation.

Common problems were primarily exit-site infections (ESIs) and potential episodes of peritonitis. All patients were reminded to perform careful hand washing and meticulous PD connection and disconnection

procedures during their self-management. In addition, daily exit-site care with a hypochlorite solution was recommended. If the patient notified the PD nurse after early recognition of an ESI, topical therapy with triple antibiotic cream or mupirocin cream was recommended, together with increased exit-site care and dressing changes. If the patient notified the PD nurse after several days of an ESI, oral antibiotic therapy with cephalexin for 7–10 days was added to the increased exit-site care and dressing changes. If no improvement occurred after 5 days, or if peritonitis developed, arrangements were made with a local nephrologist for evaluation.

For patients with suspected peritonitis, when cloudy fluid, low-grade fever, and the presence of minimal discomfort was reported within 24 hours, oral treatment with amoxicillin–clavulanic acid and a fluoroquinolone was provided empirically. If no improvement occurred in 48 hours, patients were referred to an emergency department or nephrologist for further evaluation and management. Patients with severe pain, blood-tinged dialysate, or other constitutional symptoms, including high fever or nausea and vomiting, were referred to an emergency department for further evaluation and management. Life-threatening symptoms, such as chest pain, shortness of breath, weakness or other neurologic symptoms, required immediate referral to an emergency department for further evaluation and management. Two patients that were directed to emergency care required admission to hospital for further evaluation and management of volume overload with uremia and peritonitis.

Extensive flooding in New Orleans has resulted in the extended closure of many health care facilities and hospitals, including the Tulane–DCI dialysis facility. Provision of care was therefore subsequently moved to another DCI facility on the West Bank of New Orleans, where flood damage did not occur. As a result of the severe damage to personal residences, only 8 of the original 22 patients returned within the first month following resumption of the PD program. Since the relocation and resumption of the program, additional patients have begun PD training.

Discussion

Every health care facility must be prepared for disasters, whether natural or man-made. Man-made disasters often occur as a result of accidents at industrial facilities (such as the fire at a petroleum refinery in

England in 2005) or of railroad or other transportation accidents (for example, fires and chemical spills), and a host of other events that may disrupt municipal water supplies and thereby affect health care facilities. Electrical distribution failure may result in widespread blackouts or brownouts that disrupt business operations, especially dialysis facilities. Terrorist activities must also be considered as a potential cause of unexpected man-made disaster. Natural disasters may wreak the same type of havoc; however, with the exception of earthquakes and tornadoes, most can be predicted, and disaster plans can be implemented immediately. Recovery from these events begins with disaster planning.

Disaster planning for dialysis patients truly addresses a life-or-death situation: If dialysis cannot be provided, the patient's life is placed in extreme jeopardy. In developing a disaster plan, contingencies for an entire spectrum of events from minor disruption to complete failure of services, including interruption of telecommunications and utilities and property destruction, need to be considered (2).

The first step in disaster planning is to identify types of disasters that may potentially occur in the given area and how these disasters may affect the services provided by the dialysis program. The plan should address each potential type of disaster. Stakeholders with the dialysis program—patients, health care providers, dialysis suppliers, utility providers, public safety agencies, and other health care facilities—may need to be consulted in developing the plan.

Hurricanes are the major concern for people in the southern Gulf Coast, but earthquakes strike worldwide, resulting in massive devastation in the affected areas, creating challenges that require acute dialysis and not just maintenance of chronic dialysis services (3,4). In 1989, the Loma Prieta earthquake disrupted chronic services temporarily for most of the northern portion of California. Cooperation from members of the TransPacific Renal Network maintained chronic dialysis services by shifting patients to available resources in adjacent communities (4). Important lessons learned from that disaster mitigated the interruption of dialysis services from natural disasters that occurred subsequently in California, including wildfires and flooding accompanied by mudslides in Southern California and sporadic flooding from torrential rains in various areas of the state.

In the case of Hurricane Katrina, reconstitution of the PD program began immediately following the storm, before the full extent of the flooding had been realized. Contact via cellular phone is normally paramount in locating patients in emergency situations. The program therefore routinely obtains home, work, and cellular telephone numbers for contact. This system failed in the aftermath of Katrina. Much of the delay in contacting patients resulted from the simultaneous failure of cellular, traditional telephone, and cable-based telephone networks. Disaster planning must include contingencies for such an occurrence, and contact lists need to include e-mail addresses and additional emergency contact information.

Following Hurricane Hugo in 1989 in South Carolina, problems occurred with the restoration of utilities; similar problems occurred in the New Orleans area following Katrina (3). Lessons learned from Hugo that were applied during Katrina included the provision of a disaster guide to patients at the beginning of hurricane season as part of a routine clinic visit and discussion of the guide with the patient by the nursing staff and social worker. One month before Hurricane Katrina, Tropical Storm Cindy struck New Orleans, giving the PD program an opportunity to test its plan. Although no flooding occurred at that time, wind damage to trees resulted in scattered power outages throughout the city for up to several days, with concomitant interruption to CCPD. Some patients used the facilities of the PD unit; others performed CAPD during their home electrical service interruption.

The same plan was re-implemented as Hurricane Katrina approached. However, the evacuations in the New Orleans area required the nursing staff to undertake more extensive contact with patients. For patients who did not plan to evacuate, a reminder was provided that no utilities would be available following the storm. In some cases patients reconsidered their decisions, made plans to evacuate, and completed the necessary arrangements. In other cases, information on performance of CAPD in lieu of CCPD during power failures was reiterated, and advice on stocking up on additional bottled water and nonperishable food items was provided.

Following the storm, it was necessary to determine the needs of each patient and his or her plans for return. The most immediate need for most patients was shipment of emergency supplies. Several

patients were able to accomplish this task on their own. The PD nurse communicated with dialysis suppliers to arrange delivery of supplies when transportation services resumed. In other instances, the PD nurse contacted PD programs in evacuation cities to obtain a limited supply of emergency items, including erythropoietin.

For patients who determined that they would be unable to return to New Orleans, arrangements were made for transfer to another PD program. As part of the patient transfer process, medical records were forwarded to the new program. Paper medical records were largely destroyed in the dialysis unit, but electronic information from a centralized system was available, including demographic information, medication profiles, and laboratory studies. Additional medical records were obtained from the information system at Tulane University Hospital and Clinic by request from patients to the health information department. Routine systems for obtaining health care information were completely disrupted, which highlighted the importance of conversion from paper-based medical records to electronic information storage with appropriate redundancies to minimize loss when disasters occur (5).

The Tulane–DCI PD program is part of the DCI network of dialysis centers. That network served as a resource for the Tulane–DCI PD nurse and staff nephrologists. Inclusion of the dialysis center's DCI corporate resources in the disaster planning process meant that the program was completely transportable to a new site, minimizing interruption of services. Corporate resources may also facilitate the establishment of transient dialysis for individual patients, loan of medical staff when patient numbers change, and provision of additional equipment and supplies until emergency restocking and repairs can occur.

Network 13, the end-stage renal disease network for Louisiana, served as another resource during the recovery effort. The Network provided information on the location of hemodialysis patients when patients could not be reached using emergency contact information. Future disaster planning should include standards for incorporating network and corporate programs to help coordinate disaster management for dialysis patients across facilities and geographic locations.

Hurricane Katrina created unprecedented disruptions to health care in the Gulf South. Hospitals were

closed; patients, physicians, and other health care providers were evacuated; and services were disrupted for prolonged periods. Katrina emphasized the importance of each patient developing and following a disaster plan. Such plans must consider how to handle these items:

- Essential medical supplies
- PD supplies, medications, and information
- Emergency medical contact information, including an evacuation city
- Essential medical records and medical information
- Personal health insurance and other insurance information, including documentation
- Contingency plans for housing if the disaster is prolonged or if a personal residence is significantly damaged
- Direct deposit to a financial institution with branches in multiple locations for receipt of social security benefits, retirement, or payroll checks or other financial transactions
- Other necessary personal supplies, possessions, and information needed for evacuation and recovery

All stakeholders in dialysis services should be included in the disaster plan. In addition, a post-disaster debriefing session should occur to determine what worked and what needs improvement. Appropriate modifications of the plan should occur, and a new plan should be disseminated to all stakeholders. When possible, practice exercises should be held to familiarize patients and staff with the plan.

Conclusions

Careful and well-planned preparation can minimize the impact on patients of natural and man-made disasters. For dialysis patients and others who require unique life-support systems, preparation is essential. The experience of the PD staff in caring for the PD patients at one facility in New Orleans following Hurricane Katrina may provide valuable lessons for other facilities as they make their own disaster plans.

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