

UNDERSTANDING DIALYSIS

Dialysis is needed when the kidneys have been damaged and can no longer remove enough water and waste products. The term dialysis means "to clean." It is a process that removes waste products and extra water from the body. Dialysis is done to:

- Remove waste products
- Remove extra water
- Help the body maintain chemical balances

In order for dialysis to take place, there must be a membrane with tiny holes to filter waste products from the blood. You will hear the term "semi-permeable membrane." Semi-permeable refers to the fact that the membrane allows some substances to pass through, but keeps other substances from leaving the body. For example, waste products can pass through the membrane. Large molecules such as red blood cells are not able to pass through the membrane.

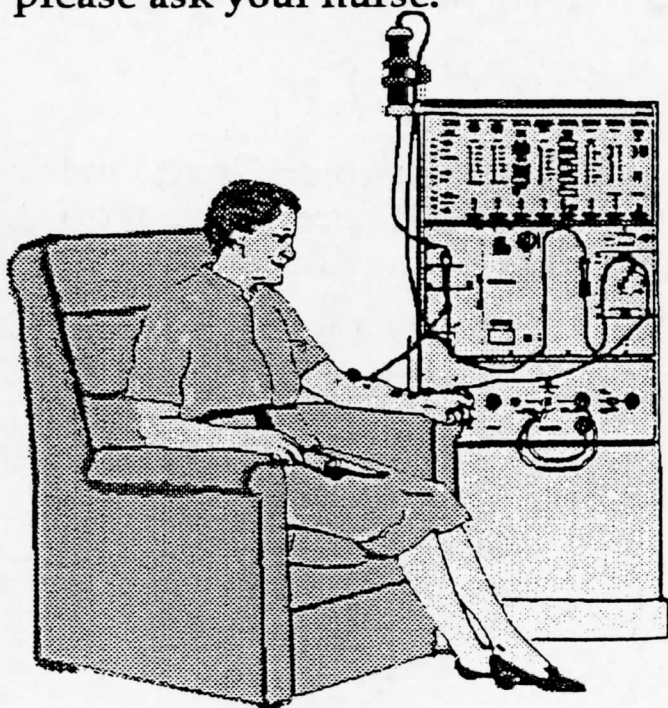
Hemodialysis and Peritoneal Dialysis are two different kinds of dialysis. Each uses a membrane to filter waste products out of the blood. The following pages will describe the differences between the two types of dialysis.

Hemodialysis

In the medical word hemodialysis, "hemo" means blood and "dialysis" means to clean. Hemodialysis is the type of treatment that uses an "artificial kidney" or dialyzer. A dialysis machine uses a pump to pull a small amount of blood from the body through special tubing into the dialyzer. Once the blood reaches the dialyzer, the semi-permeable membranes inside the dialyzer filter waste products, extra chemicals, and water. Filtered blood is then returned to the body.

A rapid blood flow is needed for hemodialysis, so it is necessary for a doctor to surgically enlarge a blood vessel. An enlarged blood vessel is called a fistula. Doctors can also create a large artificial vessel called a graft. If a fistula or graft is not ready when dialysis is needed, a catheter may need to be placed in a large vessel under the collar bone. Vascular access is the medical term for a fistula or graft. Vascular access means there is an access to the blood that will provide the high blood flows needed for hemodialysis.

Hemodialysis works very well for many people who need dialysis. If you need more information about hemodialysis, please ask your nurse.



In Summary

Hemodialysis requires that:

1. A special access to the blood be made surgically.
2. Blood be pumped from the body to a dialyzer.
3. Blood be returned to the body after it is filtered.

Continuous Ambulatory Peritoneal Dialysis

Since Continuous Ambulatory Peritoneal Dialysis (CAPD) was introduced in 1977, thousands of people have learned to use it at home with great success. CAPD is a method of doing dialysis for patients with kidney failure. Let's look at what CAPD means.

C (Continuous) - This type of dialysis works 24 hours a day. Even while you sleep!

A (Ambulatory) - This type of dialysis allows you to move freely, just as you normally would.

P (Peritoneal) - The peritoneal membrane is the semi-permeable membrane that filters waste products and extra water.

D (Dialysis) - A term that means "to clean."

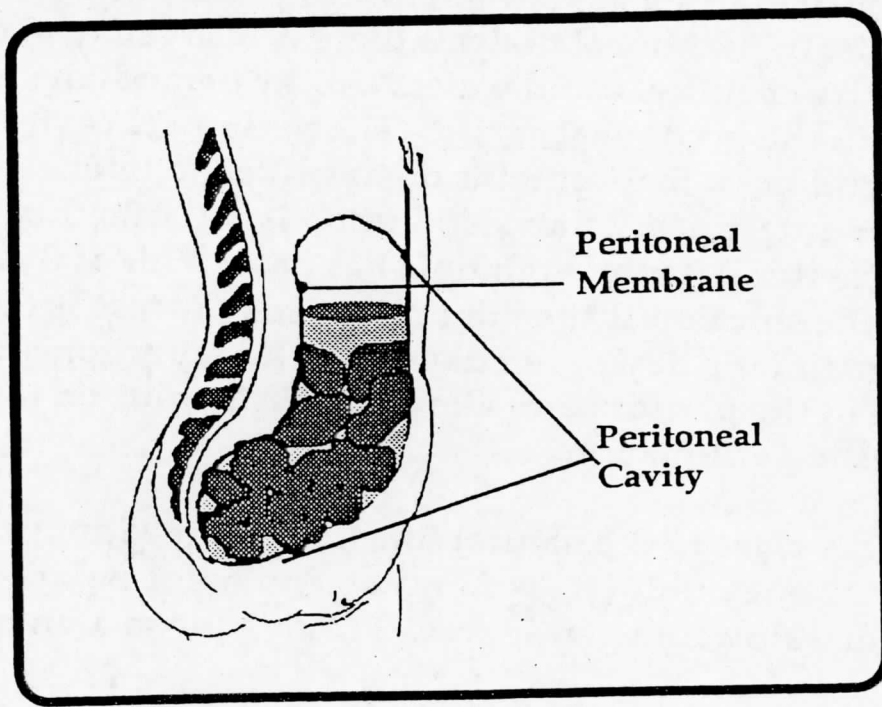
Peritoneal dialysis has several things in common with hemodialysis. In peritoneal dialysis there is also removal of waste products, extra chemicals, and water. Unlike hemodialysis, CAPD takes place in the peritoneal cavity. The peritoneal cavity is the part of the abdomen that contains organs like the liver, stomach, kidneys, and intestines. Dialysis solution is put into the peritoneal cavity. After enough time has passed for dialysis to take place, the solution is then drained. This process is carried out four or more times a day, seven days a week. A peritoneal catheter (or catheter in the peritoneum) allows dialysis solution to fill and drain from the peritoneum.

CAPD is close to the natural function of the kidneys. It rids the body of waste products, extra water, and helps balance chemicals in a slow and gentle way. This results in a unique

process of on-going dialysis which is like the action of the normal kidney. By following your prescribed treatment, your water balance and chemical balance will be more stable. Most important, CAPD does one thing that hemodialysis can not do, it frees you from a machine.

The Peritoneal Membranes

There are two peritoneal membranes in the abdomen. One of the membranes lines the peritoneal cavity. The peritoneal cavity is in the abdomen and holds organs like the stomach, liver, and intestines. The second peritoneal membrane covers these organs. These two linings make up the peritoneal membrane. There is a space between these two layers of the peritoneal membrane. This space is called the peritoneal cavity or peritoneum. It is large enough to hold the dialysis solution (dialysate) that is used in peritoneal dialysis. There are many small blood vessels (capillaries) in the peritoneal membrane. These small blood vessels are on one side of the peritoneal membrane and the dialysis solution is on the other side of the peritoneal membrane.



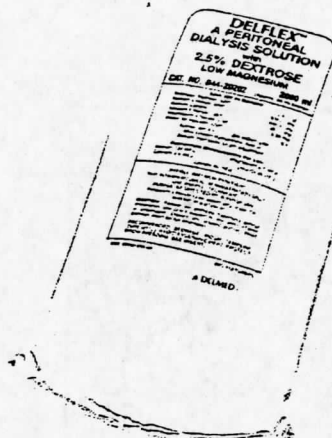
How Peritoneal Dialysis Works

Dialysis is the process that cleans the blood of extra water and waste products. Water moves from the area that has the largest amount of water, across the peritoneal membrane, to the area that has the smallest amount of water (most concentrated side). This is called osmosis. With osmosis, the body tries to make the water balance on both sides of the membrane.

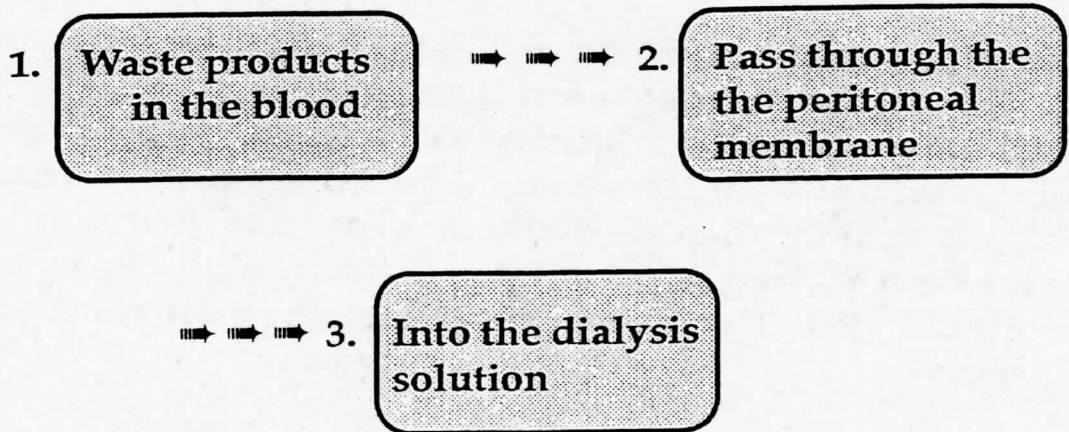
Concentration is a term you will hear often. Concentration refers to the "strength" of a solution. Dextrose (sugar) is added to the sterile water in dialysis solutions to change the concentration. Your blood will usually be less concentrated (have more water and less dextrose) than the dialysis solution. In order to help you remove the right amount of extra water, dialysis solutions come in 3 different strengths. The higher the number, the more water will be removed.

- A 1.5% solution will remove less than a...
- 2.5% solution and a 2.5% solution will remove less than a...
- 4.25% solution.

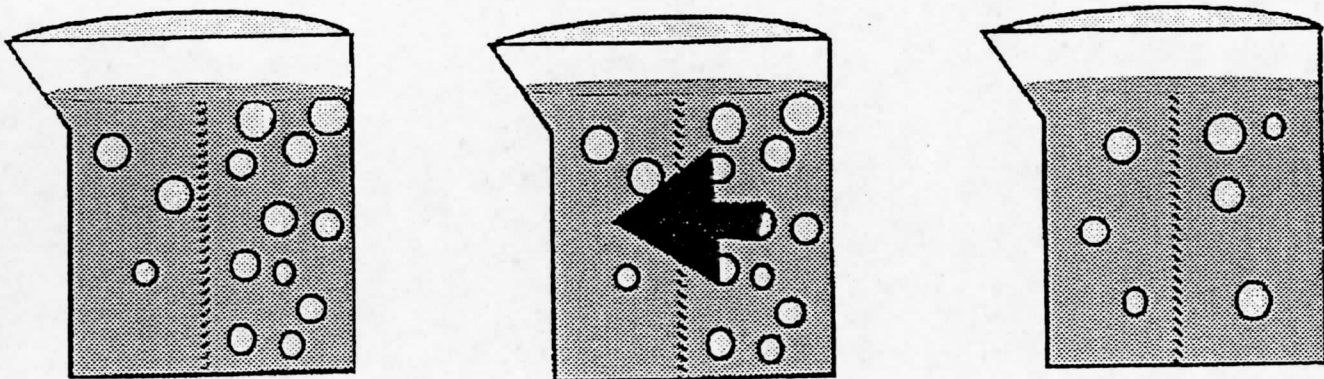
During training, you will learn when you should use the different solution strengths.



Waste products and extra chemicals are removed from the blood through a process called diffusion. The dialysis solution has no waste products and contains a proper amount of chemicals. When the solution is put into the peritoneum, the waste products and extra chemicals are drawn from the blood across the peritoneal membrane and into the dialysis solution. The process works as follows:

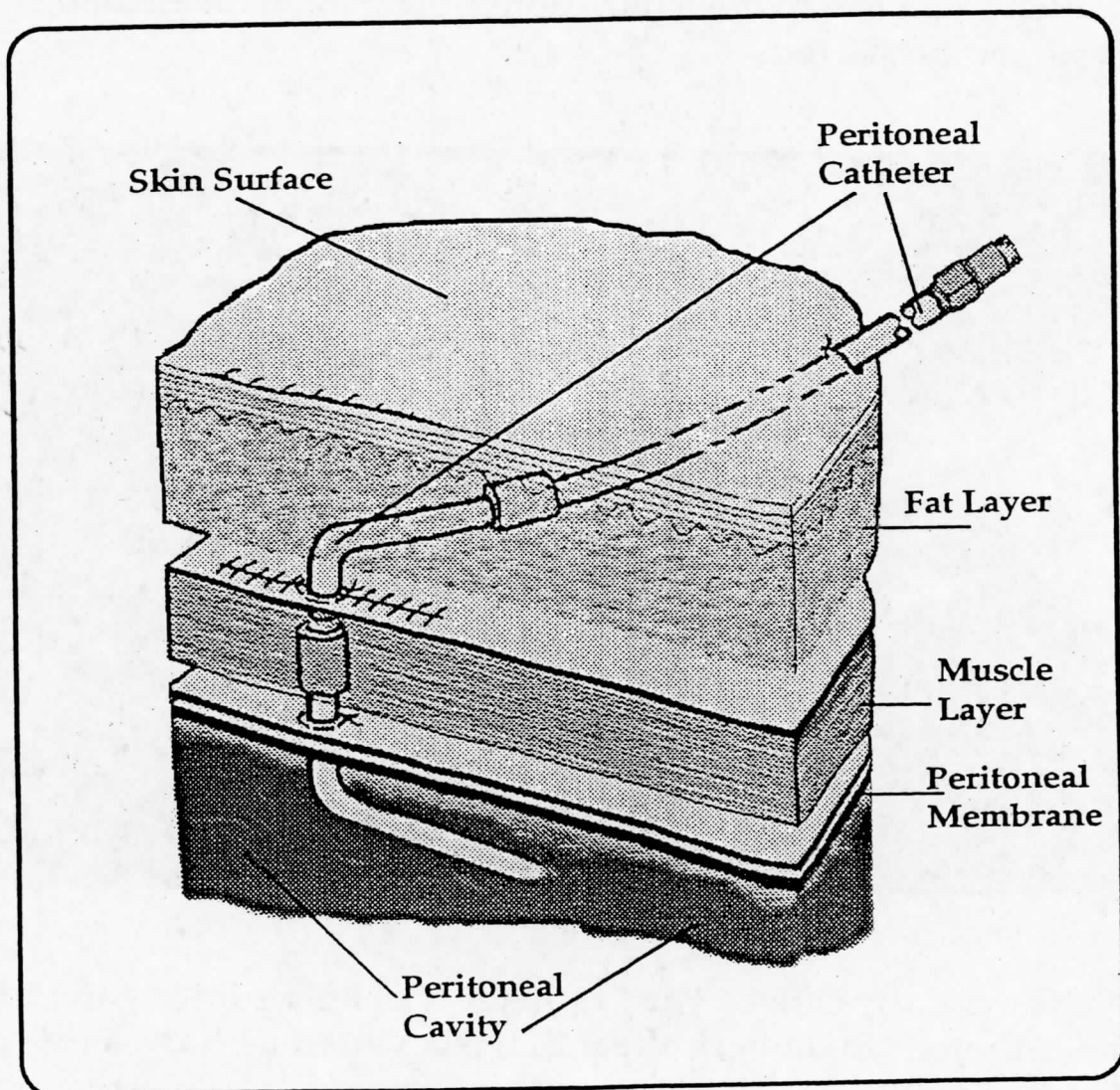


Another example of this is to think of a measuring cup that is divided by a semi-permeable membrane. On one side of the membrane is water with a large amount of salt (sodium). On the other side is dialysis solution that contains little salt. The salt particles on the concentrated side will slowly move to the side that has little salt. When there is an equal amount of salt on both sides of the membrane, the movement stops.



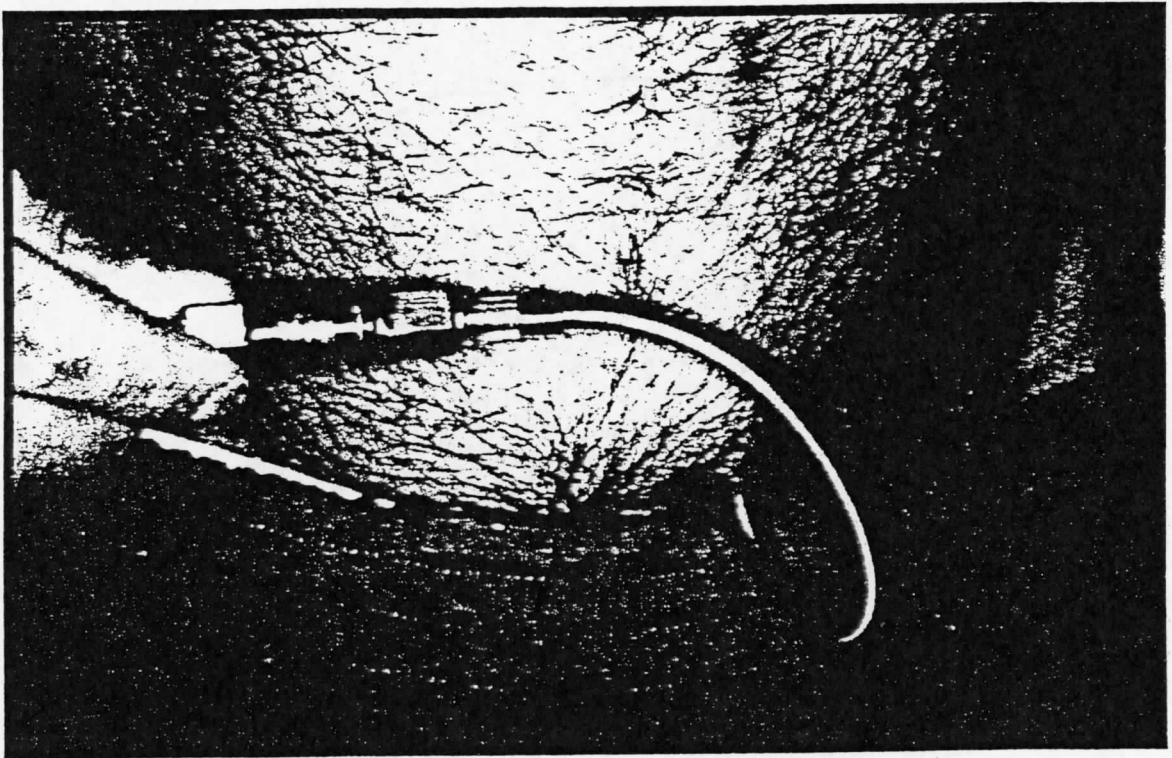
The Peritoneal Catheter

To fill and drain the peritoneal cavity of solution, an opening is surgically made in the abdomen. A soft catheter is inserted in the peritoneum and sewn in place. There are many kinds of catheters and many ways to insert the catheter. The catheter is placed by a surgeon or nephrologist in the operating room or special treatment room. It is a simple and short process. Once the catheter has been placed, there will be a few days of discomfort where the opening was made.



The skin will heal around the catheter and hold it in place. After the catheter is in place, there is a period of care called conditioning before the catheter is ready for use. This is needed for proper healing and to prevent leaking of the dialysis solution. It is very important to avoid pulling on the catheter..... especially while the catheter site is healing.

There is a portion of the catheter outside of the body which will be hidden under your clothes. A bandage will be put over the place where the catheter comes out of the body (the exit site). The training nurse will teach you how to take care of the catheter exit site. The training nurse will also tell you when the exit site is healed and you can bathe again. Once the exit site is healed, dialysis can be started.



Proper daily care of your catheter will help prolong the life of the catheter. To do peritoneal dialysis you must have a catheter that works well!

The CAPD Exchange

During CAPD, the dialysis solution stays in the peritoneum long enough to pull the extra water and waste products from the blood. This period of time is called the dwell or dwell time. At the end of the dwell, the fluid holds waste products and extra water. After the dwell time has passed, it is time to drain the fluid. When the fluid has drained it is then time to fill your peritoneum with fresh solution so the dialysis process can begin again.

This process of filling, dwelling, and draining is called:

THE CAPD EXCHANGE

Let's look closer at the CAPD exchange:

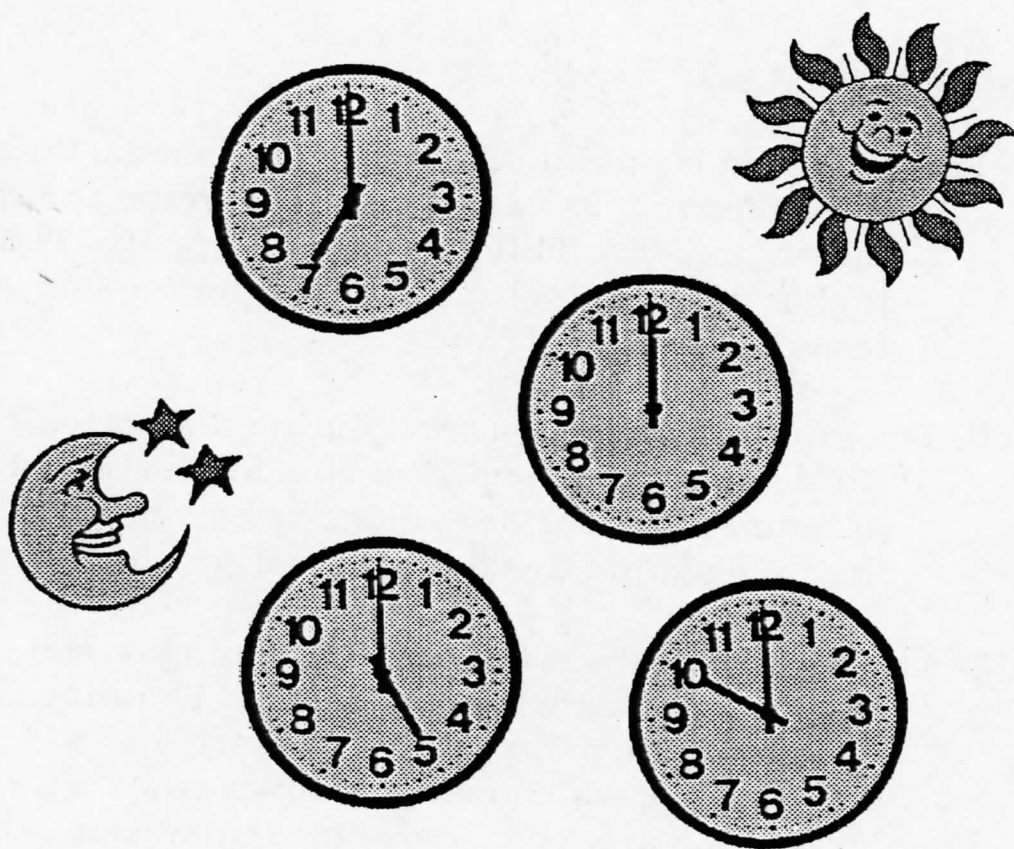
Fill - Fresh solution is put into the empty peritoneum through the catheter. It usually takes 5-10 minutes to fill the peritoneum. Filling is done by gravity. The higher the solution bag above the peritoneum, the faster the fluid will flow.

Dwell- The process of dialysis occurs during this stage. The fluid will stay in the peritoneum for a set number of hours. Your doctor will decide how many hours the fluid should dwell in your peritoneum.

Drain- After the dwell stage, the fluid containing waste products and extra fluid is drained. Draining is done by gravity, through the catheter, into a drainage bag which will be thrown away. The level of the drain bag or distance from your abdomen will affect how fast the fluid flows through the tubing into the drain bag. The closer the drain bag is to the floor, the faster the solution will flow.

Your doctor will also determine how much fluid you will use during each exchange. The peritoneal cavity has a capacity for up to three liters of fluid. During your first few exchanges, you may have a feeling of fullness when you fill the peritoneum with dialysis solution. After a while, the feeling of fluid in the peritoneum will be routine. Daily activities will not be curtailed while you carry the dialysis solution within you. That is the beauty of CAPD.

Your doctor will decide how many exchanges you should do each day. An example of some exchange times are: 7 A.M., 12 noon, 5 P.M., and 10 P.M. Your nurse can help you in making a schedule that fits your own needs. With CAPD you can plan your dialysis around your normal routines instead of changing your routines around dialysis.



Preventing Infection

There are factors that contribute to the success of home CAPD:

1. You must understand what dialysis is all about.
2. You must stick to the exchange procedure you have been taught. There can be NO shortcuts!
3. You must always perform aseptic technique.
4. You must call the doctor or nurse immediately if you think problems are developing.

Aseptic Technique

Although CAPD is a terrific option for dialysis patients, there are problems that may occur if the steps for CAPD are not followed as taught. The main problem you want to avoid is peritonitis (an infection of the peritoneum).

You have to be careful when making connections to the catheter or bag of dialysate. If not done exactly as taught, there is a chance that bacteria (germs) will enter the body. If germs get into the peritoneum, you may get an infection called peritonitis. Once the membrane is infected, dialysis cannot be performed because the membrane cannot filter as it should. Repeated infections will scar the peritoneal membrane and cause pain. This is why using an aseptic technique is so important. Aseptic means "without germs." When you use aseptic technique you do not get germs into the peritoneum.

The dialysis solution used for CAPD is sterile (without germs or bacteria). The part of your CAPD tubing (often called a transfer set) where the dialysis solution travels to and from your peritoneum is sterile too. If you do not use aseptic technique,

germs will enter the sterile fluid and travel into your peritoneum. The steps you are taught in home training are designed to prevent bacteria from entering the sterile fluid.

You need to understand that there are bacteria all around us. There are germs on our hands and on the things we touch. It takes just one germ to cause peritonitis. A single germ can turn into over a million in just five hours! You can prevent germs from entering your CAPD system by doing the following things:

1. Gather your supplies first.
2. *Always wear a mask.*
3. *Always wash your hands.*

Those 3 things must be done everytime you do an exchange. During your training you will learn the proper way to do things and with practice the proper steps will become second nature to you. On the next few pages, we will look at how you can prevent infections, the signs and symptoms of infections, and how infections affect dialysis.

The Basic Rules of Aseptic Technique

As mentioned above, aseptic technique prevents germs from getting into your CAPD system. If you follow these rules each time you do your exchange and do not take short cuts, you can avoid infections.

The Exchange Area- Whether you do your CAPD exchange at home, work, school, or some other place, the same rules hold true.

Rule #1: Concentrate on what you are doing. It can be very easy to become distracted. When you do not

concentrate, mistakes can happen.

Rule #2: The area where you do your CAPD exchange should be kept clean. Even though you can not see the germs and bacteria, they are on everything. Keeping your work area clean will not remove all the germs, but can remove many of them.

Rule #3: Realize that germs can move in air currents. Have you ever seen a ray of sunshine and noticed dust and other particles in the sunshine? Germs can move in air currents too! Wearing a mask during the exchange, keeps you and others from breathing germs into your CAPD system. This is why you must wear a mask. It is also why anyone else in the same room must wear a mask. In fact, there should be as few people in the room as possible. Children or pets should not be in the room at all. To keep air movement to a minimum:

- Close all doors
- Close all windows
- Turn off any ceiling fans
- Shut all air conditioning or heater vents

Rule #4: Gather all of your supplies before you start doing the exchange. Having all of your supplies within reach will help prevent mistakes. Your supplies should always be kept dry. Germs grow in moisture.

Rule #5: Scrub your hands with a good soap. Your dialysis nurse can suggest a good soap for you to use. Whenever possible, use a liquid, pump soap instead of a bar soap. Hand washing removes many of the germs that are normally found on everyone's skin. You should scrub, not gently wash, your hands before each exchange to remove as many germs as possible.

Selecting Your Exchange Area

The following are things for you to consider when deciding which area would be best for you to do your exchanges:

- ✓ The room should be away from family activity, such as a bedroom or spare room.
- ✓ The room should be free of clutter.
- ✓ You should be able to close all the vents and windows in the room.
- ✓ The room should have a good light.
- ✓ You should have a flat table in the room to do your exchange that can be cleaned.
- ✓ You should have a comfortable chair to sit, during the exchange that is not too high or low to the table.
- ✓ Your nurse may ask that you move plants from the room, if that is best for the exchange area.

Peritoneal Dialysis Infections

All the good things that peritoneal dialysis does for you can be spoiled by one thing, infection. There are 3 types of CAPD infections that you need to avoid.

1. Peritonitis
2. Exit site infections
3. Tunnel infections

Most of your training involves ways to prevent and recognize the 3 types of infection.

Peritonitis

Peritonitis is an infection of the peritoneum. Anything that comes in contact with your peritoneum must be kept sterile (without germs). Some of the things which must be kept free of germs are: the dialysis solution, the catheter and tubing connections, the inside of the catheter and tubing, medicines, and the syringes and needles you use for adding medicines to the dialysis solution. When these things are not kept sterile, germs can enter the peritoneum and cause peritonitis. Dirty things must not be used. If something is dropped on the floor, throw it away or leave it until after your exchange.

Signs and Symptoms of Peritonitis

These are the 4 main signs of peritonitis. You may have just one of these signs or you may have many of these signs. Even if you think, you might have just one of these signs, call your dialysis unit right away.

1. Cloudy Dialysis Solution- This is when your drained

fluid is cloudy. When fluid is cloudy, you can not see clearly through the bag. There may be clumps or strands of fibrin in the bag. Fibrin is a thread-like protein that can sometimes be seen in effluent (drained dialysis solution). Even though the effluent may be cloudy and have fibrin, it will usually remain its normal yellow or amber color. You should look at every bag of drainage to check for cloudiness.

2. Abdominal pain- This can range from a dull ache, mild cramping, to a sharp pain.
3. Fever and chills- These can be mild or severe also.
4. Nausea or vomiting

Even though many of these symptoms may seem like the flu, you should always suspect peritonitis. You may have early symptoms of peritonitis. A sample of your drainage will be sent to the lab for a culture. Antibiotics must be started right away. The lab will try to find out what germ caused the infection. By finding out the germ, your doctor can make sure you are taking the right antibiotic.

Peritonitis and the Dialysis Process

When the peritoneum becomes infected, several things can happen. The first thing that can happen is the peritoneum becomes porous (leaky). A "leaky" peritoneum makes it easier for the sugar in dialysate to enter the blood. It also lets more protein leave the body and enter the dialysate. The membrane is unable to filter water and waste products properly. Also the catheter can become plugged from fibrin which is the body's response to infection. Repeated infection can cause scarring. Dialysis can not take place across a badly scarred peritoneum. Because the peritoneum goes through these changes during infection, the diet

and dialysis schedule often need to change until the infection is cleared.

Exit Site Infections

The exit site is the area of the body where the catheter leaves the skin. You should clean this area at least once a day with soap and water. Cleaning your exit site should be routine. It can often be done while showering. You will learn during training how and when you should clean your exit site. Your dialysis unit may have you put a dressing over your exit site during training.

Signs of Exit Site Infections

You should look at your exit site and catheter every day. If problems do occur, you can often catch them in the early stages. Signs of exit site infection are:

1. Drainage from the exit site that may be gray, brown, cream, yellow, or green in color.
2. Redness around the exit site.
3. Swelling or bulging around the exit site.
4. Tenderness or pain at the exit site.

Each day, you should look at your catheter for signs of cracking or pulling. Clothes and belts should not be worn tightly around the exit site. Remember, call your dialysis unit right away if you think there might be a problem with your exit site.

Tunnel Infections

Tunnel infections refer to an infection in the tunnel or path the catheter takes under the skin on its way to the peritoneum. If an exit site infection goes untreated, it can develop into tunnel infection. The infection can move down the tunnel into the peritoneum causing peritonitis. Your nurse or doctor will show you how to examine your tunnel area. Examine your catheter tunnel daily. Gently press along your tunnel from the middle of your abdomen to the exit site. You should feel no pain or have any drainage come from the exit site.

Signs of Tunnel Infections

The signs of a tunnel infection are:

1. Pain along the tunnel path.
2. Fever.
3. Warmth, thickening, swelling, and/or a red streak over the tunnel path or tract.

Your dialysis unit must be called right away if you see any of these signs. The dialysis unit will arrange for a culture of the area and for antibiotics to be started right away.