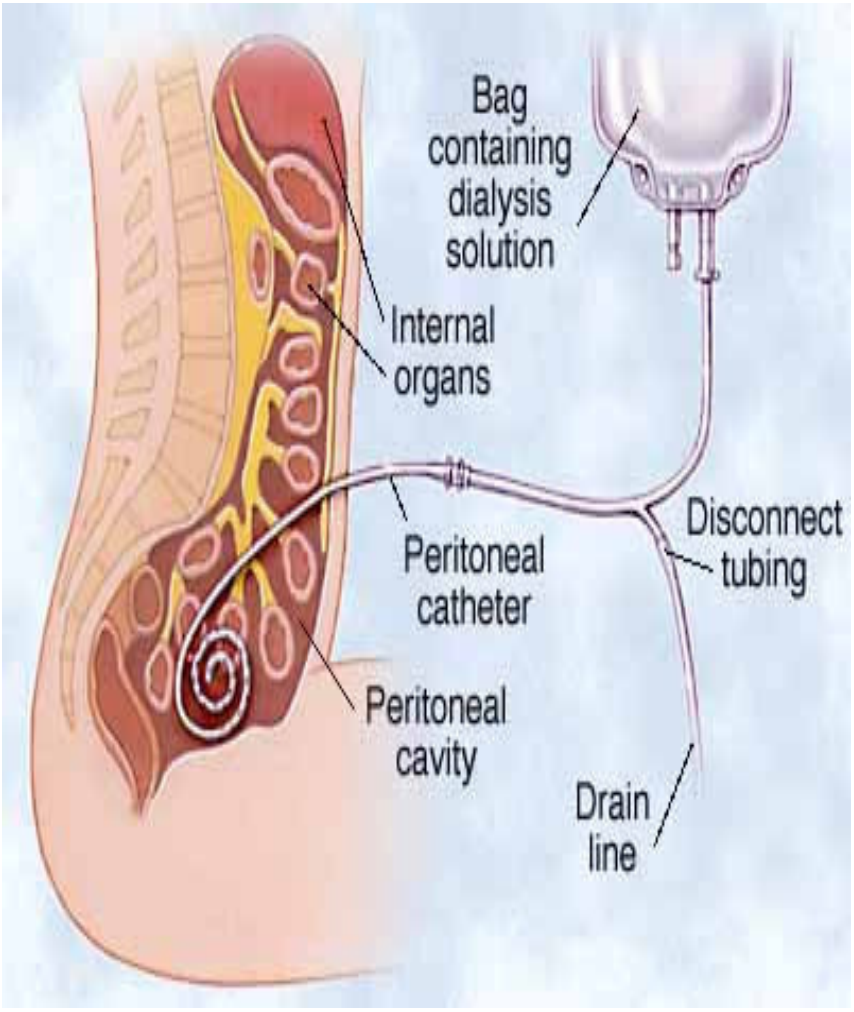
Renal Self Learning Package

INTRODUCTION TO PERITONEAL DIALYSIS



RENAL SELF LEARNING PACKAGE
INTRODUCTION TO PERITONEAL DIALYSIS

GOAL

This learning package has been designed to assist the participant to independently increase his/her knowledge related to the care of the patient requiring peritoneal dialysis.

PACKAGE OBJECTIVES

To enable the participant to:

- Outline the physiological principles of peritoneal dialysis;
- Describe the three (3) basic components required for peritoneal dialysis;
- Demonstrate a clear and practical understanding of the peritoneal dialysis process;
- Describe the different peritoneal dialysis therapies and their management;
- Identify the potential complications of peritoneal dialysis and discuss the appropriate management of each;
- Participate in the management of the patient requiring peritoneal dialysis treatments.

OVERVIEW

Peritoneal dialysis is a renal replacement therapy used widely for managing end stage chronic kidney disease. A thorough understanding of this therapy and related physiological processes is essential for providing nursing management of patients requiring peritoneal dialysis when admitted to the ward.

A number of journal articles have been compiled into a reference compendium, which is available to borrow from the clinical nurse educator.

You will also need to access the hospital policies and procedures for *nephrology protocols and procedures/peritoneal dialysis.*

There are questions throughout the package which you can complete. If you have any trouble, do not hesitate to ask your preceptor, an experienced peritoneal dialysis nurse or the CNE for assistance.

BACKGROUND

Peritoneal dialysis is a renal replacement therapy that utilises the peritoneum as the dialysis membrane. During dialysis the patient's blood passes on one side of a semi-permeable membrane, while a dialysis solution passes on the other side. Waste products and excess fluid pass across the membrane and are then drained and discarded. Large particles such as blood cells are too big to pass across the membrane and remain in the blood stream.

The functions of the kidney which can be replaced by peritoneal dialysis are:

- The removal of wastes and toxins including the end products of protein metabolism (urea), and muscle breakdown (creatinine);
- Electrolyte balance;
- Correction of acid/base balance;
- The removal of excess fluid from the body.

Q1 List three important functions of the kidney that cannot be corrected by peritoneal dialysis and the treatment options available to overcome these problems:

1.

2.

3.

It has been well known for a century that it is possible to exchange solutes across the peritoneum. However, it was not until the late 1970s that peritoneal dialysis was introduced as an alternative to haemodialysis. Since this time, peritoneal dialysis has been developed significantly into a user friendly and flexible therapy and is now the dialysis treatment of choice for many people.

At our hospital peritoneal dialysis is most commonly used as a long term treatment for advanced chronic kidney disease but on the rare occasion it can be used for other applications such as peritoneal lavage in cancer patients.

The Renal Department boasts a progressive Peritoneal Dialysis Service and we have a CNC and CNS staff who are responsible for the training and follow up of patients. On average there are about 60-70 patients who perform peritoneal dialysis at home.

During peritoneal dialysis three processes are involved in removing fluid and wastes from the bloodstream and balancing electrolytes. These processes are:

1. Osmosis
2. Diffusion and
3. Convection

To understand what is happening during peritoneal dialysis it is important to have an understanding of the following basic principles.

Q2 Complete the following table regarding the processes involved in peritoneal dialysis:

Process	Definition	Application to PD
Osmosis		
Diffusion		
Convection		

Ultrafiltration (UF) is another important process of peritoneal dialysis. UF occurs due to the osmotic force of the glucose in the dialysis fluid and results in the movement of fluid from the patient's blood into the dialysis fluid. The extra fluid is called the ultrafiltrate.

Three basic components are required for peritoneal dialysis:

1. the peritoneum
2. access to the peritoneum
3. dialysis fluid

Each of these components as well as the techniques and complications of peritoneal dialysis will be addressed in this package.

THE PERITONEUM

The peritoneal membrane lines or encloses the abdominal cavity and covers the organs within including the stomach, liver, spleen and intestines. The peritoneum is the largest serous membrane in the body with a surface area approximating that of the skin. In adults, this is 1-2 m^2.

The peritoneal membrane is divided into two portions and the peritoneal cavity is the space between the two membranes. In normal circumstances the cavity contains a small amount of serous fluid. However, this cavity can potentially hold up to 5 litres of fluid depending on individual body size. The peritoneal membrane acts as a barrier or filter. It is richly supplied with capillaries delivering approximately 70mls/min of blood to the dialysis site.

Review the A and P of the peritoneum in the readings compendium

Q3 Name the 2 layers of the peritoneum and the surfaces they cover:

Q4 Outline the blood supply to the peritoneum:

The omentum is a fold of peritoneum which hangs from the stomach. The omentum has a number of important functions but in general its role is to protect the abdomen and its contents by the secretion of a lubricating fluid and by acting as a *shock absorber* when there is physical injury. The omentum also has a role in immunity and fat is stored in the omentum which can be absorbed by the body when required.

PERITONEAL DIALYSIS ACCESS

To enable the use of the peritoneum as a dialysis membrane, dialysis fluid is infused into the peritoneal cavity. This occurs via a peritoneal dialysis catheter (PDC) which is inserted in the operating room by a vascular surgeon or in the cardiac catheter lab by an experienced renal physician. The PDC remains insitu and is cared for by the patient.

The most widely used catheter is made of silicone rubber or polyurethane and has two Dacron cuffs situated around the proximal end of the catheter. The catheter has rows of tiny side holes along its distal curled half to allow infusion and drainage of the dialysate fluid (see figure 1).

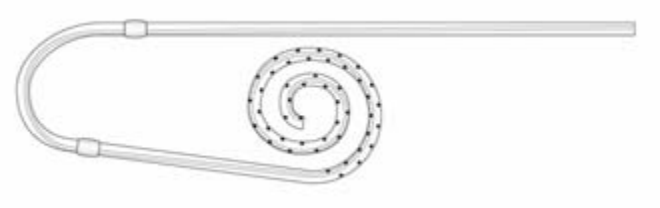


Figure 1 showing a peritoneal dialysis catheter

The PDC is inserted deep into the peritoneal cavity and then comes out a puncture on the skin. The diagram below shows the placement of the catheter:

- The external segment — visible outside the body
- The tunnelled segment — the part of the catheter that is tunnelled through the subcutaneous tissue and the rectus muscle
- The intra-peritoneal segment — inside the peritoneal cavity

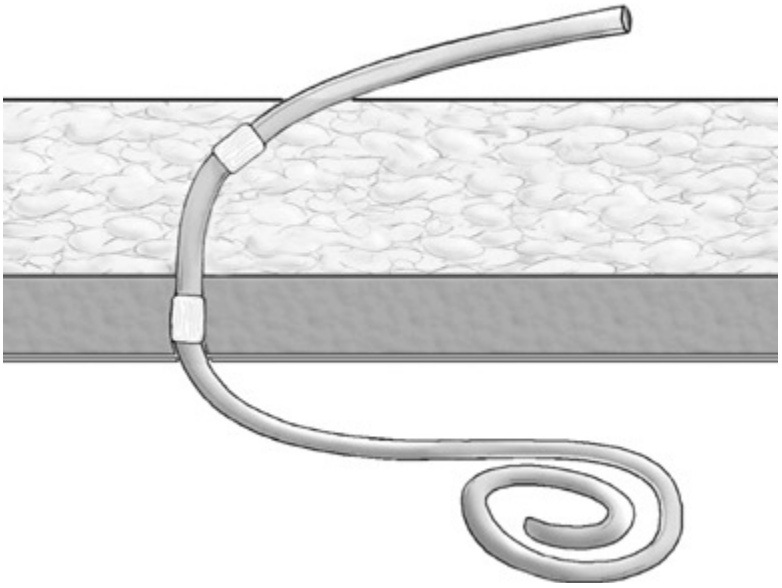


Figure 2 Placement of the PDC

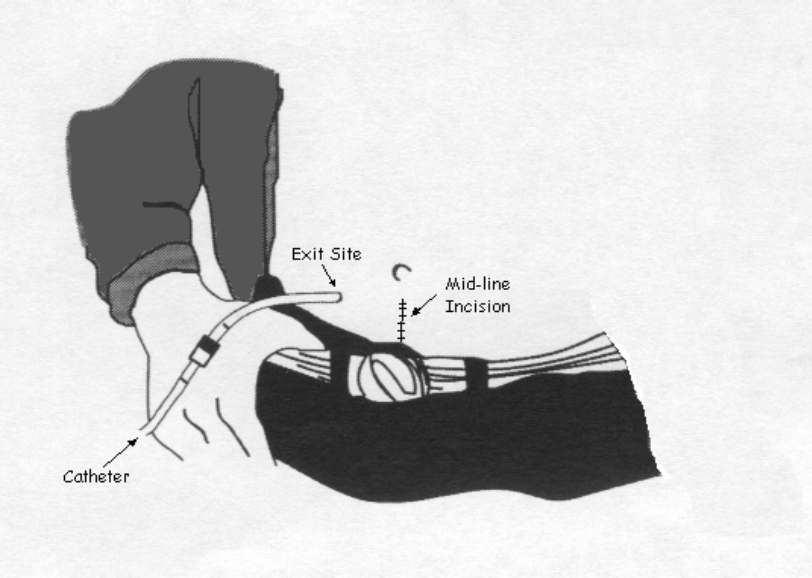


Figure 3 Diagram showing external position of PD catheter

It is vital that good care of the catheter is maintained. The catheter should be kept immobilised by tape to the skin at all times and the exit site covered with a simple *cutiplast* or *tegaderm* dressing (other if skin allergies). Exit site trauma from dropping an unsupported catheter must be avoided as this can contribute to exit site infection. The exit site should be observed, cleaned and redressed on a daily basis.

Take a look at the poster on the wall in the 4 south Peritoneal Dialysis Clinical Room displaying a peritoneal dialysis catheter.

DIALYSIS FLUID

Peritoneal dialysis fluids are commercially produced and come in various volumes. The usual adult will require at least 2,000ml of fluid to be infused per exchange. Peritoneal dialysis fluid is warmed to body temperature before it is instilled because warming increases the efficiency of the dialysis and is more comfortable for the patient.

Glucose is used as the osmotic agent in most types of dialysis solutions. Glucose has the advantage of being familiar, relatively safe and inexpensive and is also a source of calories. Although the glucose is a valuable agent for removing excess fluid from the patient it can be detrimental to the patient and peritoneal membrane. To overcome the problems of continual use of high glucose containing dialysis fluids much research has been conducted to find an alternative and some of them are now available but expensive.

Another alteration to dialysis fluid is the addition of amino acids which are used for nutritional

supplementation and they are usually instilled and absorbed during one 4-6 hour dwell/day. Icodextrin is a poly glucose preparation and induces ultrafiltration (UF) by its osmotic effect. The outcome is a more sustained UF than glucose. For this reason the main indication is for patients with UF failure. It is used for a long dwell either at night in CAPD or during the day in automated peritoneal dialysis.

Take a walk to the Peritoneal Dialysis Clinical Room.

Q5 List the four different strengths of Baxter Dianeal solution according to dextrose concentration?

1.
2.
3.
4.

Q6 List the standard components of Baxter Dianeal and give a rationale for their addition to peritoneal dialysis fluid?

Component	Amount	Rationale
Sodium		
Magnesium		
Calcium		
Chloride		
Lactate		

Q7 Potassium is not a standard constituent of peritoneal dialysis fluid. Give a rationale for potassium not being included in peritoneal dialysis fluid:

PD fluid is warmed before being instilled. Warmers are available for CAPD bags. Can you locate them in the room and do you know how to use them?

THE PERITONEAL DIALYSIS PROCESS

Peritoneal dialysis is a relatively simple procedure and is carried out by patients in their own homes.

Each peritoneal dialysis exchange has three phases:

1. **Infusion**

Dialysis fluid flows into the peritoneal cavity by gravity or with the help of a machine. It takes approximately 10 minutes for 2000 ml to enter the cavity. Factors, which affect the rate of infusion, include:

2. **Dwell**

Dialysis fluid remains in the peritoneal cavity for a predetermined period of time. The period of time varies according to the type of peritoneal dialysis required.

3. **Drain**

Dialysis fluid drains from the peritoneal cavity carrying with it excess fluid and waste products. Drainage time varies according to catheter function. Usually 10-30 minutes for 2000 ml plus ultra filtrate (extra fluid removed from patient). As a safety precaution the first step in the PD process is actually a drain cycle.

Factors, which effect PD fluid inflow and outflow, are:

- External occlusion i.e. kinks in the line or PDC
- PD catheter tip position
- height of peritoneal dialysis fluid above patient
- Internal i.e. constipation/omental wrapping
- Intra-abdominal pressure
- Width of the lumen
- Tubing length

Q8 If you came into the room and the patient complained that the PD fluid was not running in or out. What do you think might be the most obvious cause?

PERITONEAL DIALYSIS THERAPIES

Continuous Ambulatory Peritoneal Dialysis (CAPD)

The first phase of CAPD involves the drainage of the dialysate from the peritoneal cavity. The dialysate includes extra fluid and waste products which are not required by the body. Once it has drained, fresh peritoneal dialysis fluid is infused. While the peritoneal cavity is empty dialysis cannot occur so stage two involves the instillation of fresh peritoneal dialysis fluid. Stage three is the period in which the fluid remains indwelling while the patient attends to his/her usual activities. The dwell period is 4-6 hours and then phase one is undertaken again. In most cases there is no need for the patient to conduct an exchange while they are asleep although there are assist devices which can perform an exchange for the patient while they sleep. The diagram below summarises the phases of CAPD.

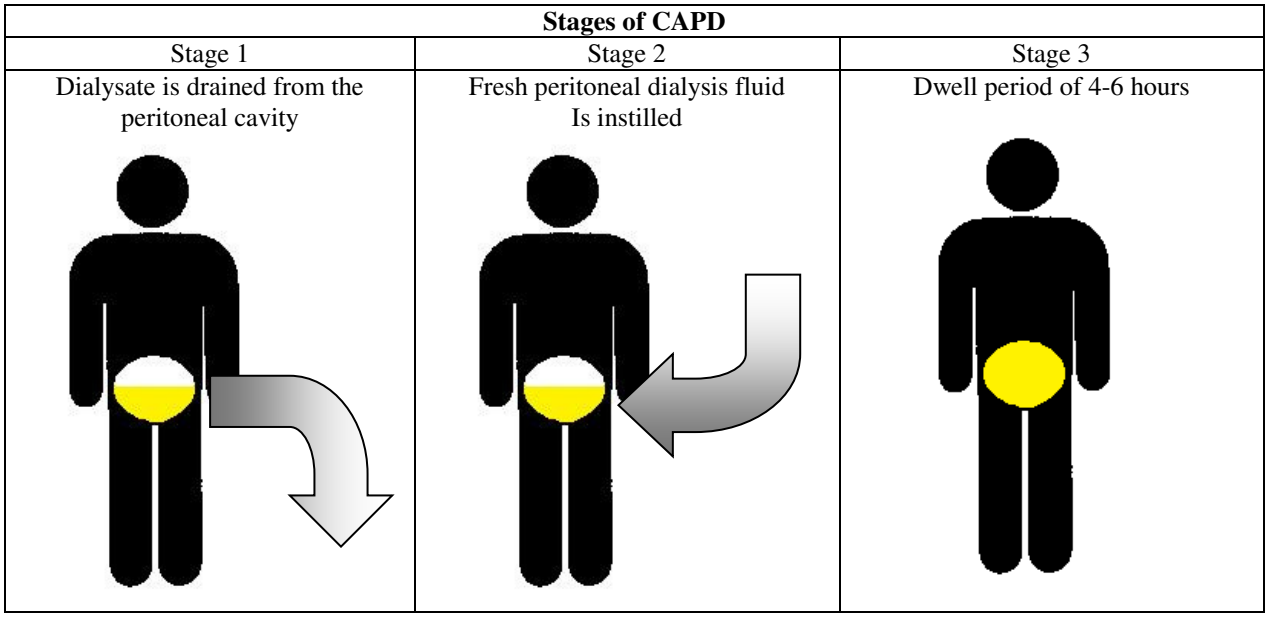


Figure 4 showing the phases of CAPD

Continual Cycling Peritoneal Dialysis (CCPD)

Utilises a machine to perform the dialysis exchanges. Patients will perform the dialysis while they are in bed at night. The machine is prepared with 2-3 large volume bags of dialysis fluid which are warmed by a special warming cradle on the machine. The machine will infuse the required dose of 2-3 litres and allow it to remain insitu and then automatically drain the dialysate. This process will be repeated a number of times overnight dependent on the particular patient requirements.

Intermittent Peritoneal Dialysis (IPD)

Exchanges are performed by the PD machine. IPD is usually performed in hospital for 24-48 hours as required.

CARE OF THE PATIENT REQUIRING PERITONEAL DIALYSIS

Weight

Should be performed daily when patient is empty and recorded on the peritoneal dialysis chart and the FBC

Nutrition

Approximately 40% of people on peritoneal dialysis are undernourished. Protein loss into the peritoneal dialysis fluid, anorexia, nausea and vomiting all contribute to poor nutritional status. Therefore, close attention and early intervention for peritoneal dialysis patients is necessary. Patients admitted to the ward will require a peritoneal dialysis diet.

PD exit site care

Will depend on whether the catheter:

- Has been recently inserted – usually the dressing remains intact and must be kept dry
- Is a long term catheter - the patient will shower and perform own dressing daily but while in hospital you will perform supervised until you have successfully mastered the skill.

POTENTIAL COMPLICATIONS OF PERITONEAL DIALYSIS

Peritonitis

Infection of the peritoneum is the most frequent complication of peritoneal dialysis. New delivery systems and techniques have resulted in a decrease in the incidence of peritonitis. Peritonitis remains the most common reason for hospitalization and is still a major cause of failure for this method of dialysis.

Q9 Access the *policies/protocols* and list the common signs and symptoms of peritonitis from the Peritonitis protocol

While you are reading the protocol review the treatment principles for peritonitis

PDC exit site infection

Infection around the PDC exit site is an important observation when performing an exit site dressing. The signs to watch for are

- Purulent discharge surrounding exit site
- Swelling and erythema surrounding area
- Painful area to touch

Take another peek in the Peritoneal Dialysis Clinical Room and look at the PDC exit site flip chart which shows graphically what a healed (good) exit site looks like. There are also examples of what an exit site might look like when there is a problem.

Congratulations!!!!

You have now completed this learning package. If you are staying on 4 South as a permanent member of staff you will be required to completed the *Peritoneal dialysis advanced package* and the *Care of the peritoneal dialysis patient competency*. Please see the CNE for a copy.

Take some time to reflect on your learnings

Think about what you now know about Peritoneal Dialysis and make some notes below about an area which you want/need to explore further