Predialysis: hemodialysis or peritoneal dialysis

azdelta
Uw ziekenhuis.

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Dear patient,

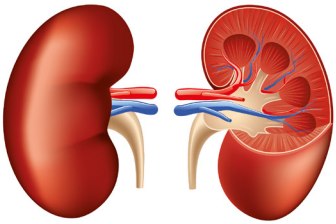
You have just been informed by your attending physician that your kidneys are not functioning properly and that you will become dependent on dialysis in the future.
You probably have a lot of questions, but you cannot or do not dare to ask them.
You may feel a need to have a conversation or obtain some information, or you may wish to talk to someone who is in the same situation.
The doctor, nurse and social services are always prepared to listen to you and answer the questions you have.
The aim of this leaflet is to help you, together with your doctor, choose the treatment that is most appropriate for you and suits your lifestyle.

The Department of Nephrology

1. General information

1.1. Anatomy of the kidneys

The kidneys are bean-shaped organs located outside the peritoneum on both sides next to the spine, approximately at the level of the lumbar region.



Kidneys (Shutterstock)

A normal adult kidney is about 12 cm long, 5 cm wide and weighs about 160 grams. A kidney consists of several layers of tissue and the renal pelvis. It is a very blood-rich organ.

In fact, a kidney is composed of one million small units (nephrons) that work more or less independently. The blood is purified in the first part of such a nephron. A large quantity of highly diluted filtrate is formed there, containing not only a lot of water and waste products, but also useful substances. Most of the water and useful substances are recovered from the filtrate in the last tubular part of a nephron. What remains is the urine.

1.2. Functions of the kidneys

The kidneys filter the blood 24 hours a day.

- They remove **excess fluid** from the body.
- They remove **waste products** from the body (food releases harmful waste products such as urea) through the urine.
- They are also responsible for **maintaining certain substances** in our body (e.g. potassium).
- They regulate the **acidity** (pH) of the blood.
- They produce a hormone **(erythropoietin)** that stimulates the bone marrow to produce red blood cells.
- They also produce a hormone that plays a role in **blood pressure regulation** (renin).
- In addition, the kidneys play a role in regulating the calcium content in the bones by producing the active form of **vitamin D**.

1.3. Causes of chronic kidney disease

- Diabetes: 35%
- Years of uncontrolled blood pressure
- Atherosclerosis of the renal artery (arteria renalis)
- Kidney cysts, hereditary
- Chronic kidney inflammation, e.g. due to kidney stones
- Kidney damage due to years of taking pain-relieving pills or powders
- Sometimes the cause is unknown

1.4. Symptoms of kidney disorders

When only 15% of the kidney is working, and the various functions are no longer recovering, this is called **end-stage renal disease** and renal replacement therapy is necessary.

You may suddenly be confronted with end-stage renal disease due to a very rapid decline in kidney function, but this may also be a process that takes years.

People with advanced kidney disease may have one or more of the following symptoms to varying degrees: **fatigue, drowsiness,** discomfort in the legs, **muscle weakness**, sensation of burning feet, **headache**, vomiting, decreased or increased urine production, tightness in the chest, shortness of breath, oedema (**accumulation of fluid under the skin**, e.g. in the feet, ankles or face), **itching and/or cramps**, gout (due to accumulation of uric acid), **bad breath,** rapid bruising and nosebleeds, **high blood pressure**.

These symptoms are due to the fact that the kidneys are not adequately excreting the **waste products** of metabolism and finally, also **water**.
Among other things, phosphates can accumulate in the blood, stimulating the parathyroid gland. The result is decalcification of the bones and calcification of the blood vessels, among other things.

With a rapid decline in kidney function, the symptoms of the disease are usually more pronounced. People have more symptoms than when the loss of kidney function is slow: they feel sicker.

2. Replacement therapy

Without treatment, end-stage renal disease is life-threatening. It is therefore necessary to replace kidney function.

Based on your symptoms and blood test results, the attending physician will choose between continuing treatment with **drugs and diet** (e.g. low salt, fluid restriction, low potassium, protein restriction) or starting **renal replacement therapy**.

Three types of renal replacement therapy are possible:

- hemodialysis or artificial kidney treatment: the blood is artificially purified through an artificial kidney
- peritoneal dialysis: daily flushing of the abdominal cavity by means of a flushing fluid
- kidney transplant

Hemodialysis and peritoneal dialysis are equivalent in terms of blood purification. Patient survival is not affected by the choice of one particular technique. Medical factors can play a role in the choice, but usually both techniques are possible.
Not everyone is suitable for all forms of renal replacement therapy. Your doctor and nurse will help you choose the treatment that is most appropriate for you.

2.1. Hemodialysis (artificial kidney treatment)

2.1.1. Generalities

Hemodialysis is the most commonly used treatment so far. During artificial kidney treatment or dialysis, your blood is purified outside the body using a dialysis machine.



Example of dialysis machine (AZ Delta)

The blood is temporarily prevented from clotting and pumped through a filter, the artificial kidney.

This artificial kidney contains a semi-permeable membrane. The blood flows through very thin tubes on one side of that plastic membrane, and dialysis solution (dialysate) flows on the other side.



Example of artificial kidney (AZ Delta)

The artificial kidney has a dual function: on the one hand, waste products and excess water flow through this membrane into the dialysis solution, and, on the other hand, useful substances can be added to the blood. The purified blood is returned to the patient.

The artificial kidney will therefore:

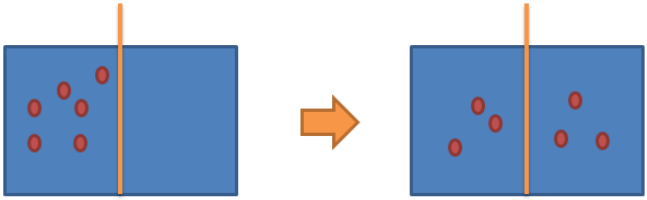
- remove waste products such as urea, creatinine and uric acid
- extract excess water (ultrafiltration)
- correct the acidity of the blood by absorbing bicarbonate from the dialysis solution.

For this treatment, the patient must visit the artificial kidney clinic three times a week for about four hours each time.

The exchange of ions and waste products takes place in two ways:

1. **Diffusion**

Waste products from the blood pass through the membrane into the dialysis solution when the concentration of the substance in the blood is higher than that of the dialysis solution. The exchange takes place until the concentrations in the blood and the dialysis solution are the same.



Example of diffusion through the semi-permeable membrane of the artificial kidney (AZ Delta)

Because the dialysis solution is constantly being refreshed, we see that the concentration of this substance in the dialysis solution is not becoming equal to that of the blood, so the exchange continues. The opposite is also true. When there is a substance in the dialysis solution with a higher concentration than that of the blood, we see that there will be a transfer of that substance from the dialysis solution to the blood.

2. Ultrafiltration

If the hydrostatic pressure in the blood compartment is higher than that in the dialysis solution, the fluid from the blood will be forced through the membrane. Fluid can also be extracted from the blood by creating negative pressure on the dialysis solution. This removes plasma water and all of the substances dissolved in it.

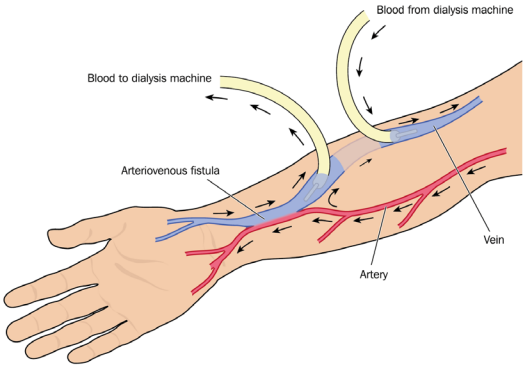
If possible, the fistula is created at least four to six weeks before the start of haemodialysis.

2.1.2. Access route: fistula - catheter

A good access route to the bloodstream is needed to enable a sufficiently powerful blood flow through the artificial kidney. A distinction is made between:

- the creation of a fistula
- the use of a catheter (temporary or permanent)
- the use of a catheter in combination with a fistula

a) Creation of a fistula at least four to six weeks before the start of haemodialysis.
This is an internal surgical connection of an artery and a vein. Because of the greater pressure in the artery, blood is sent to the superficial vein, which will expand and become easy to insert needles into.
This is usually done using the blood vessels of the forearm.



Example of a fistula (Shutterstock)



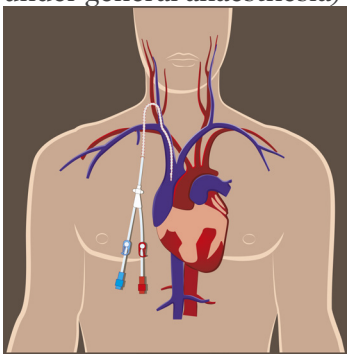
Example of a fistula (Shutterstock)

The fistula is the patient's lifeline and must always be well cared for and monitored by him or her.

The nurse punctures the fistula with one or two needles every dialysis session.

b) Fistula placement at the time dialysis begins
A temporary or permanent catheter (tube) is then also placed for dialysis, and the catheter is used until the fistula is developed and easy to puncture.

If the placement of a fistula is impossible, a permanent catheter will be surgically implanted at the base of the neck (usually under general anaesthesia) in the operating theatre.



Example of a dialysis catheter (Shutterstock)



Dialysis catheter (AZ Delta)

To prevent clotting in the catheter, a small amount of anticoagulant medication will be introduced into the catheter after each dialysis session.

c) A combination of the fistula with the catheter
In some cases, the fistula is combined with the catheter. The blood is then drawn through the fistula and returned through the catheter.

2.1.3. Diet and medication

In addition to dialysis, diet, fluid restriction and medication are important.
Blood samples are taken monthly, and the doctor will use the results to adjust your medication individually.

You must also adhere to the diet:
- restriction of fats, products containing salt and potassium
- adequate protein intake
- low potassium (e.g. max. one piece of fruit/day + low intake of vegetables)
- fluid restriction: e.g. 600 ml per day for someone who no longer has any remaining kidney function.

The less weight you gain between dialysis sessions, the better you will tolerate the dialysis.

Drinking more means more fluid in the body with often unpleasant or severe consequences: swollen feet, high blood pressure, shortness of breath and prolonged dialysis time. In time, this can cause strain on the heart.

2.1.4. Introduction to hemodialysis

Hemodialysis takes place in our hospital (the main centre) under the responsibility of our kidney specialists.

In total, approximately 210 to 220 patients are treated with hemodialysis at the main centre.

Patients are on dialysis per group: the first group comes on Monday, Wednesday and Friday mornings, the second group in the afternoon of the same days, the third group on Tuesday, Thursday, and Saturday mornings and the fourth group in the afternoon of the same days.

The centre operates from Monday to Saturday from 7 a.m. to 6:30 p.m.
The on-call service is available all other times of the week.

Dialysis is also possible at a CAD (Collective Auto Dialysis clinic, associated with the main centre in Roeselare). The CADs associated with AZ Delta are: Menen, Tielt, Veurne and Torhout. Patients may choose this option because of the shorter distance from their place of residence to a CAD or because of familiarity with the hospitals listed.

A number of factors are important for dialysis at a CAD location.

- Treatment at a CAD (not the main centre) requires the patient to be medically stable.
- Additional or recurrent medical problems mean treatment will have to be at the main centre, whether or not temporarily, according to the patient's progress.
- Each application for treatment at a CAD must take into account the places available and often requires some waiting time.

2.1.5. Practical course of a dialysis session

You can come to the dialysis clinic by a patient transport service, a taxi or your own car.
This will be reimbursed to you, and the amount will vary depending on the form of transport and the health insurance fund.
On arrival, you will be weighed and your blood pressure measured. You will then be connected to the artificial kidney.
All technical activities, such as operating the equipment, preparing for dialysis, puncturing the fistula and aftercare, are carried out by dialysis nurses.
You will be given a cup of coffee during the dialysis session (if you tolerate the dialysis well).
Diabetic patients may (if desired) have breakfast in the dialysis dining room.
In the course of the dialysis session, your blood pressure will be checked regularly (the machine will also be monitored) and the doctor will visit.
After dialysis, the patient can have lunch at the restaurant (for those having dialysis in the morning).

The total time you are away from home for one treatment is the transfer time to and from the hospital, the time for connection and disconnection (+/- 30 min) and the dialysis time, which usually lasts four hours.

2.1.6. Showering

If you have an arteriovenous fistula in your arm as an access route, showering and bathing are no problem at all. Bathing with a catheter is not recommended. Showering is only allowed if the catheter is sufficiently protected with a transparent plaster.

2.1.7. Travel

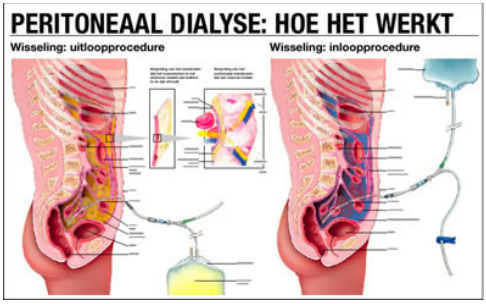
You will still be able to travel at home and abroad. You can then have dialysis temporarily at a clinic near your travel destination.

2.2. Peritoneal dialysis (or peritoneal flushing)

2.2.1. Generalities

This is a blood purification method inside the body using the peritoneum as a filter.

The peritoneum is a thin membrane that covers the organs and is very rich in small blood vessels. The peritoneum is a semi-permeable membrane. This means that some substances can pass through it (e.g. water, salts, waste materials such as urea) and others cannot (e.g. blood cells). So the peritoneum works as a kind of artificial kidney.
The total surface area of the peritoneum is 1 to 2 m^2.



Peritoneal membrane (Vantive)

Once surgically implanted in the lower abdomen, a **catheter** is used to let a certain solution enter into the abdominal cavity. Exchanges occur between the solution that has entered and the blood that flows through all the blood vessels of the peritoneum.



Peritoneal dialysis catheter (Vantive)

Peritoneal dialysis takes place in three phases: the filling phase, the dwelling time and the draining phase. Together they form one cycle.
During the **filling phase**, a quantity of sugary liquid called dialysate flows through the catheter into your abdomen. This liquid remains in place for a certain time – the **dwelling time**. During this phase, waste products and excess fluid move from the blood to the dialysate.
Finally, during the **draining phase**, the fluid is allowed to flow out of the abdomen.

The catheter is the patient's lifeline in peritoneal dialysis. Regular monitoring of the catheter entrance and strict, proper care are required.



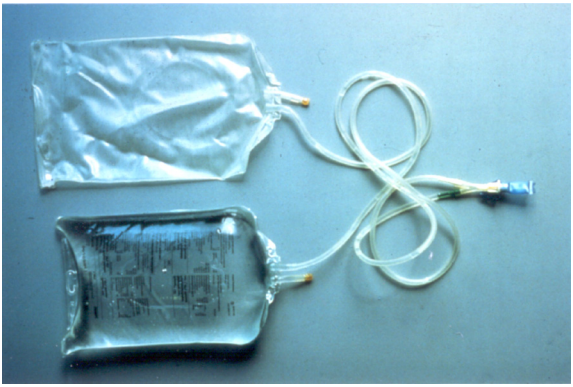
Peritoneal dialysis catheter (Vantive)

Normally, you take care of the dressing yourself, or your partner, a carer or a home nurse does; they also have to follow specific training for this purpose.
Self-treatment at home requires good training, **being well-motivated and having a sense of responsibility.** Regular check-ups by a doctor are still recommended. Consultations take place every four to six weeks!

2.2.2. Forms of peritoneal dialysis

a) CAPD (Continuous Ambulatory Peritoneal Dialysis)
This is done at home while on continuous dialysis. This technique is performed four times a day.

The exchange takes 20 to 30 minutes, using a TwinBag.
It is made up of a flushing fluid bag (i.e. a 2-litre bag) connected to an empty drain bag by a closed system.



Example of a TwinBag (Vantive)

You connect this closed system to the catheter during each exchange.



Example of CAPD (Vantive)

The exchange starts with draining the fluid in the abdominal cavity (into the empty bag); the patient then lets the warmed liquid solution run into the abdominal cavity.
It is important that the exchange always takes place in a calm, clean, well-lit environment.

b) APD (Automated Peritoneal Dialysis)
In APD, dialysis takes place using a machine at night.



Example of an APD machine (Vantive)

Peritoneal dialysis by APD is carried out using a machine (a cycler) during the night while you are asleep.



Example of APD (Vantive)

In the evening, you hang a number of tubes and flushing bags on the machine (which takes 15 minutes), after which you connect to it and are thus on dialysis during the night.
You disconnect from the machine the next morning. You are free during the day.

Dialysis fluid is left in the abdomen when you are disconnected, so dialysis continues during the day.
The machine is easy to operate. The hospital has it installed free of charge in the bedroom of the patient's home. The major advantage is freedom during the day; the disadvantage is the long dialysis time at night (+/- 9 hours).

2.2.3. Diet and medication

In addition to your peritoneal dialysis, the doctor will ask you to adhere to a diet and prescribed medication.
However, the diet is not as strict as for hemodialysis patients because the dialysis is daily.
Compared to a hemodialysis patient, you will have to adhere less to fluid and potassium restrictions.
However, you will need to consume more protein, as you also lose a small amount of protein daily through dialysis.

2.2.4. Advantages and disadvantages of peritoneal dialysis compared to hemodialysis

Advantages

- No access route to the bloodstream is required.
- The patient does not need to have needles inserted.
- The blood is purified daily (continuously) and not at several-day intervals.
- No blood-thinning medication is required.
- You perform the treatment yourself.
- The treatment is done at home.
- There are fewer dietary restrictions.
- In general, there is less need for medication than with hemodialysis.
- The red blood cell count is usually higher than in persons treated with hemodialysis.
- You are independent – not dependent on nurses.

Disadvantages

- Training is needed.
- The continuous presence of a catheter in the abdomen.
- The constant presence of a few litres of fluid in the abdominal cavity sometimes causes unpleasant sensations in the abdomen (usually only at the beginning of treatment).
- The fluid in the abdomen gives a feeling of fullness, reducing your appetite.
- There is a risk of peritonitis (inflammation of the peritoneum) due to bacteria entering the abdominal cavity.

- The need to carry out daily exchanges.
- Some of the sugar in the dialysis fluid is absorbed into the body. This can lead to unwanted weight gain, which may make calorie restriction in the diet desirable.
- Loss of body proteins occurs via the flushing bags, which is why additional intake of protein is recommended.

2.2.5. Introduction and practicalities

Before the catheter is implanted, you will be expected to have fasted when you arrive at the hospital in the morning, and there may be some tests (e.g. ECG, blood sampling, chest X-ray).
The nurse will come to mark the line of your skirt or trousers on your skin.
During the implantation, the nurse will be present to test whether the catheter is positioned correctly by means of a short flush (filling and draining).
After surgery, the catheter is covered with a sterile dressing that is kept on for as long as possible. On the day of the operation, you can get up and eat something in the evening.
After two to three days, you can go home, and usually after three weeks, you will be readmitted for your training (for five days).
A nurse will visit you at home beforehand. The nurse will check where the machine will be placed, whether there is sufficient light and water in the vicinity, etc. Any adjustments that are needed (e.g. installation of a socket, etc.) will be made (free of charge to you).

For the training, everything is explained to you step by step and practised! Once you have mastered the techniques, you can go home.
The company will contact you to inform you when the monthly deliveries of the equipment will be made to your home.

The peritoneal dialysis nurse will accompany you home when you leave the hospital and assist with installing everything. He/she will also set up the machine with you again so that it is

ready for use in the evening.
Afterwards, you will be contacted by telephone, and you can get expert help 24 hours a day.
After one week, you will have a consultation with the doctor and nurse, and after that, by appointment.

During the consultation, the nurse will check your weight, the flushing schedule, your blood pressure, possibly take a picture of the catheter port, change the dressing and enter all the information into a computer.
The doctor will then examine you and prescribe or change any medication.

In case of problems

Peritoneal dialysis treatment is done at home. What if there are problems? You can always contact the specialist nurse day and night on 051 23 74 64.

2.2.6. Showering

Because the catheter is placed through the abdominal wall, there is a risk of possible infections. Bathing is therefore prohibited. Showering is allowed, provided that the catheter outlet is sufficiently shielded with a waterproof adhesive plaster before showering and is cared for immediately and properly afterwards.

2.2.7. Travel

You will still be able to travel at home and abroad. The company can deliver the required dialysis materials to your holiday destination in most countries. However, you must notify the specialist nurse in good time so that the necessary calls can be made.

Conclusion

The choice between hemodialysis or peritoneal dialysis will be made by mutual agreement between you and your doctor, depending on your condition.
You may be eligible for kidney transplantation with both peritoneal dialysis and hemodialysis.
If you have any questions, please contact a nurse on the peritoneal dialysis team on 051 23 74 64.

2.3. Transplantation

All preliminary examinations for a kidney transplant can be performed at AZ Delta. The actual kidney transplant would be performed at the university hospitals in Ghent or Leuven. When all examinations are completed, a meeting is arranged with the doctor in charge of the chosen hospital who gives his or her final consent for the transplant. The waiting time begins on the first day of dialysis!

Contact

Hemodialysis Clinic
Dialysis Dispatch
t 051 23 38 98
e dialysermt@azdelta.be

Peritoneal Dialysis Clinic
t 051 23 74 64
e PDverpleegkundigen@azdelta.be

www.azdelta.be

Source: Department of Nephrology

Physicians

Dr Gert De Schoenmakere
Dr Bart Maes
Dr Thomas Malfait
Dr Hans Schepkens
Dr An Vanacker
Dr Ignace Vandewiele

AZ Delta Deltalaan 1, 8800 Roeselare **t** 051 23 71 11 **e** info@azdelta.be **w** www.azdelta.be
0520 5279-EN **This brochure is revised on 24/04/2024**