

# *Kidneys & Kidney Failure*

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## *Haemodialysis*

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This booklet will help you to know the process of Haemodialysis in detail. It will also tell you about the disposables of Haemodialysis. In the end the advantages and disadvantages of this treatment are also described.

Haemodialysis is a process by which blood is purified by taking it out of the body with the help of a machine and passing it through a 'dialyser' (artificial kidney). An artificial kidney is needed because the patient's kidneys have failed and cannot perform their duties.

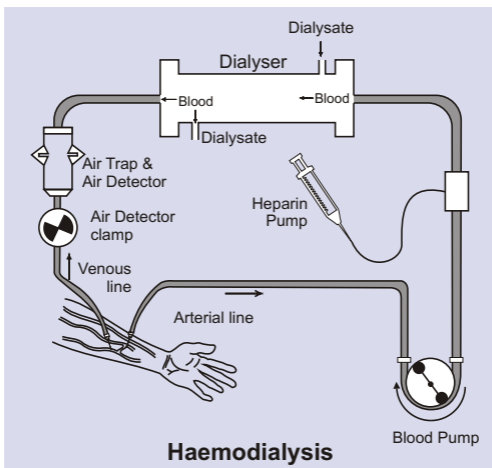
## Principles of Dialysis

The main objectives of dialysis are

1. Cleaning of toxic waste, mainly urea and creatinine
2. Removal of excess water
3. Neutralising acidity

These objectives are fulfilled by the processes of DIFFUSION and ULTRAFILTRATION.

Diffusion means removal of solutes e.g. urea, creatinine, etc. Diffusion happens because there is a concentration difference of solutes. For example, there is high concentration of urea and creatinine in blood but urea is totally absent in the dialysis solution. So urea diffuses from the blood to the dialysis solution.



Due to diffusion acetate/bicarbonate from the dialysis solution diffuses to the blood and neutralises the acidity in blood.

Ultrafiltration means the removal of excess water. It happens because the blood flows at a positive pressure and dialysis solution flows at negative pressure. The excess water flows from the blood to the dialysis solution and is removed.

## **Process of Dialysis**

The blood from the vein is taken into the needle, and through the bloodline, is passed through the dialyser. Blood and the dialysis solution do not mix in the dialyser because the dialyser membrane is a semi permeable membrane. The toxic wastes and excess water from blood goes to the dialysis solution and finally to the drain (going out of body). Acetate / Bicarbonate from the dialysis solution goes to the blood. This way the blood is purified.

After the blood has been cleaned, it is returned to the bloodline and the second needle which returns the blood into the body through a vein. This process continues for 4-5 hours and has to be repeated 3 times a week or more depending upon your body weight and medical condition.

The flow rate of the blood and the dialysis solution are maintained by pumps in the dialysis machine. The machine also helps in knowing various parameters like conductivity, temperature of the dialysis solution, amount of water being removed, amount of anticoagulant being injected and so on.

The main components of Haemodialysis are

1. Haemodialysis machine
2. AVF Needles
3. Blood lines
4. Dialyser
5. Haemodialysis Solution
6. Anticoagulant injection

## Haemodialysis Machine

It is a machine which controls the following important parameters.

1. Dialysis solution circuit
  - Flow rate
  - Temperature
  - Conductivity
  - Impurities
2. Blood circuit
  - Flow rate
  - Artery Pressure
  - Vein Pressure
  - Removal of water

It is a complex machine, but now advances in engineering and technology have made it simple and user friendly.

## AVF Needles

These are Arterio Venous Fistula Needles. In each haemodialysis session two of these are used. First for taking blood out of the body and second for putting the blood back into the body.



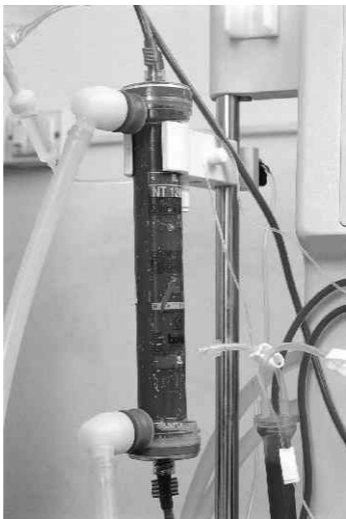
## Blood Lines

These are thick needles which are inserted at a specific site on the body (usually the non-dominant hand) where a Arterio Venous Fistula (AV Fistula) has been made. AV Fistula is created by a minor operation. Fistula is the joining of an artery with a vein so that we get the required blood flow rate.

AV Fistula is very important in Haemodialysis treatment because it is the permanent access for the treatment. In its absence, patients have to use central venous catheters.

## Blood Lines

Blood lines are attached to the end of the AVF needle. This has two sections. The impure blood section takes blood from AVF needle to the blood pump and the dialyser. The pure blood section takes the blood from the dialyser back to the body.



## Dialyser

Blood line is made up of special plastic. It is very soft and pliable. It has various attachments to facilitate various functions required during the treatment.

## Dialyser

It is the heart of haemodialysis treatment. It is the "artificial kidney". Dialyser is made up of many fibers of semi permeable membrane. Semi permeable means "it allows only selective things to pass through it". Blood is continuously pumped into the dialyser fibers. Inside the dialyser fiber blood flows while around the fiber flows the dialysis solution. The fiber allows water, urea, creatinine and small size toxic molecules to flow from blood to solution and acetate/bicarbonate and other ions to pass from solution to the blood. Dialyser fiber does not allow the blood cells to pass through it. When blood comes out of the dialyser it is clean.

Many types of dialyser membranes are available and each has its own advantages and disadvantages. Dialysers come in various surface areas to suit patient needs, e.g., a small patient will need a dialyser with small surface area and so on.

## **Haemodialysis Solution**

Haemodialysis solution is a solution consisting of water, Sodium Acetate/Bicarbonate, Calcium Chloride, Magnesium Chloride, Sodium Chloride and other ions and salts. Its composition is made equivalent to the electrolyte composition of blood. It does not contain any impurities and so a concentration difference is created between this solution and the blood. The impurities pass from the blood to the dialysis solution.

It is available in concentrated form in 10 liter jars. This is diluted by the Haemodialysis machine in the appropriate ratio. It then goes to the dialyser. After taking the impurities from blood, it is drained.

The high amount of water needed for dialysis which passes through the dialyser of the patient, can become a major source of contamination and infection. So pure water is a must for haemodialysis treatment. The water for dialysis is passed through various plants like softener, deioniser and reverse osmosis to make it pure for dialysis.

## **Anticoagulation**

An anticoagulant is used to prevent coagulation of blood in the blood tubing and the dialyser. Generally, worldwide, Heparin is used as an anticoagulant. It is added to the blood during the treatment. Its dose depends on your medical condition.

A kidney failure patient is always anaemic and loss of even a few ml of blood is critical to his health. Heparin saves the patient's blood being coagulated and thus, from wasting large amounts of blood.



## **Complications of HD**

### **1. Hypotension (Low blood pressure)**

This happens due to removal of large amount of fluid from your body in short span of time. The patients with diabetes and heart disease have higher chances of hypotension.

### **2. Muscle Cramps**

Removal of excessive amount of water and electrolytes may cause muscle cramps.

### **3. Disequilibrium syndrome**

These are a set of systemic and neurologic symptoms. It can occur either during or soon after dialysis.

Patients who are irregular on dialysis and/or are severely malnourished and/or who are old, stand higher chances of having this syndrome.



## Advantages

1. It is a treatment provided under the supervision of qualified medical staff.
2. Treatment is usually 3 times a week.
3. Chances of infection are low.
4. Comparably low cost, at present.

## Disadvantages

1. Patient has to go to the haemodialysis center.
2. Patient is dependent on machine for dialysis.
3. Salt restriction.
4. Risk of hepatitis.

## Points to Remember

1. The weight gain between two dialysis (interdialytic weight gain) has to be kept to a minimum.
2. Regularity in dialysis is a very important parameter to ensure good health while on dialysis.
3. Adherence to food and water restrictions will give better health. Also medications prescribed must be taken on time and according to the dosage.

It is important to remember that the treatment options cannot cure chronic kidney failure. This is because the damage to the kidney is irreversible. These treatments aim to reduce the production of waste products and their removal through various methods.

## Keywords

Dialysis, Haemodialysis, Dialyser, Anticoagulation, Hypotension, Disequilibrium Syndrome

Please also refer the following information booklets from India Renal Foundation for more information.

1. Choosing Your Treatment
2. Peritoneal Dialysis
3. Kidney Transplantation
4. Diabetes and Kidney Failure
5. Hypertension and Kidney Failure
6. Kidney Failure and Anemia
7. Kidney stones and Kidney Failure

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