



An introduction to dialysis

This leaflet explains about the different types of dialysis and what to expect when your child comes to Great Ormond Street Hospital (GOSH) for treatment.

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Why does my child need dialysis?

Dialysis is needed when a child's kidneys stop working properly. This can be for several reasons. Your child's doctor will have discussed with you what has happened in your child's case. Dialysis is one form of renal replacement therapy (RRT) and transplantation is the other. Dialysis will make your child feel better but it does not make them feel normal or return the blood test results to normal, as we hope will happen with transplantation. Dialysis is used until transplantation is possible.

What does dialysis do?

Dialysis does the job that is normally carried out by the kidneys. That is, it takes away the substances that the body does not need that would otherwise build up in the blood and make someone ill. Dialysis also removes salt and water from the body if the kidneys have reduced the amount of urine they are making.



How does dialysis work?

There are two types of dialysis: peritoneal dialysis and haemodialysis. Both methods have their advantages and one type may be more appropriate for your child than the other. In both types, the principal is the same: a cleaning fluid (called dialysate) is used to take the impurities, salt and water away from the blood. The impurities pass from the blood into the

cleaning fluid. There has to be a barrier between the blood and the cleaning fluid for this to happen. In haemodialysis, the barrier is the filter in the dialysis machine that the blood passes through and in peritoneal dialysis, the barrier is the layer of cells that lines the abdomen and covers the intestines (the peritoneum).

How do haemodialysis and peritoneal dialysis compare?

The following table shows the main differences between haemodialysis and peritoneal dialysis:

Haemodialysis	Peritoneal dialysis
<ul style="list-style-type: none"> ■ Takes blood from the body to be filtered 	<ul style="list-style-type: none"> ■ Does not take blood from the body to be filtered
<ul style="list-style-type: none"> ■ Uses a synthetic filter in a dialysis machine to filter blood 	<ul style="list-style-type: none"> ■ Uses the lining of the abdomen (peritoneum) to filter blood
<ul style="list-style-type: none"> ■ Is usually done in hospital but can be at home in bigger children 	<ul style="list-style-type: none"> ■ Is flexible as it can be done almost anywhere

Peritoneal dialysis

The advantage of peritoneal dialysis is that it can be done at home and your child can go to school as normal. However, we are starting a programme of home haemodialysis, which will also enable attendance at school. It does, however, mean that, with any type of home dialysis, carers have to learn the technique, and all about your child's weight and its relationship to fluid balance and blood pressure. You will need to come to the ward for training, which usually lasts at least a week. We will, of course, be available for you to ring from home if you have any concerns or questions.

Peritoneal dialysis is not always possible in all children. As it depends on the fluid being able to flow freely through the abdomen, it may not work if a child has had previous surgery to their abdomen, as after surgery, loops of gut may stick to each other (adhesions) and so stop the fluid circulating freely.

How does peritoneal dialysis work?

Peritoneal dialysis requires access to the abdomen so that the cleaning fluid can be passed in and out of it. To do this, our transplant surgeon puts a soft catheter under the skin in a tunnel and then into



the abdomen so that its tip is in the pelvis area. The other end, outside the body, is capped off when not in use. We like to give this time to heal properly before we use it, so we usually do not start dialysis for three or four weeks if possible. This is because the dialysis fluid that is put into the abdomen contains a lot of sugar, so if the tunnel under the skin is not properly healed, the fluid tracks along the tunnel alongside the catheter and leaks. If this happens, the sugar and plastic of the catheter encourage infection (tunnel infection) that can be very hard to treat.

Until we are ready to start dialysis, you and your child will come to the ward once a week. Your child will lie on a couch and our clinical nurse specialist will hang up a bag of cleaning fluid and allow it to run into the abdomen through the tube. This is called flushing the catheter. The fluid is then allowed out again by lowering the bag so that the fluid runs out by itself back into the bag. Sometimes there can be problems with drainage from the catheter. Most often this is because of constipation, which may push the tube out of position, so it is important that your child avoids this.

There are two types of peritoneal dialysis: continuous ambulatory peritoneal dialysis (CAPD) and continuous cycling peritoneal dialysis (CCPD).

Continuous ambulatory peritoneal dialysis (CAPD)

In this type, you will use the same technique as when the catheter is flushed, but the fluid is left in the abdomen until the next session, when the old fluid is let out and replaced with fresh. This needs to be done four times a day, usually first thing in the morning, lunchtime, late

afternoon and before bed. Your child can carry on as normal throughout the day otherwise. This type of dialysis may be better for older children who want to go out in the evenings.

Continuous cycling peritoneal dialysis (CCPD)

This is also called automated peritoneal dialysis or APD. A machine is used to push fluid in and out of the abdomen rather than using gravity as in CAPD. This dialysis takes place during the night while your child is asleep. The machine is about the size of a suitcase and is transportable to other houses if necessary. Usually a child needs 10 to 12 hours on the machine, so this is better for younger children. Sometimes it is possible to do an extra cycle during the day so that the length of time overnight can be shortened for older children. Usually some fluid is left in during the day as well, as this improves the amount of dialysis given.

As well as the age of the child and family preferences, there are sometimes medical reasons why CCPD is better than CAPD. In some children, fluid comes away easily and in other it does not. We do not know until we start how your child will respond.

Possible problems – peritonitis and tunnel infections

It is possible for infection to enter the abdomen, either down the inside of the tube with the cleaning fluid or along the catheter down the tunnel. For this reason, hand washing technique is crucial. If infection occurs, this is called peritonitis. The cleaning fluid, which is usually clear, becomes cloudy and the child develops abdominal pain and may have a



temperature. This needs urgent treatment and you must contact us straightaway. Episodes of peritonitis can damage the gut covering (peritoneum) across which dialysis takes place and this can reduce the length of time for which peritoneal dialysis is

possible. It is on average five years before the dialysis stops working properly and haemodialysis becomes necessary, although some children have managed to be on peritoneal dialysis for much longer than this.

Haemodialysis

Haemodialysis is usually undertaken in hospital but as with peritoneal dialysis can also be done at home in bigger children (weighing over 20kg). In this type of dialysis, there needs to be access to the blood vessels so that blood can be taken out of the body, passed through a filter to clean it and then returned to the body. Access can be either via a catheter or by a fistula:

Catheter

Catheters need to be relatively large to allow high blood flow speeds, as the higher the speed within certain limits, the better the dialysis. The catheters usually have two parts (lumens): one for the blood to leave the body and one through which it returns, and are placed in the vessels in the neck. Catheters are usually only used in an emergency or if the haemodialysis is short term or in a young child. This is because they easily become infected, which can make a child very ill. Also, if infected, they may need to be replaced, sometimes damaging the blood vessel so that it cannot be used again. It is very important to preserve blood vessels for the future, as once the kidneys have failed, either dialysis or transplantation will always be necessary, so it is important that we do not run out of access sites. For this reason, older children have dialysis using a fistula. For more detailed information, please see our *Central venous haemodialysis catheters* information sheet.

Fistulae

Our transplant surgeon creates the fistula by joining an artery to a vein in the arm. This makes the vein increase in size and become tougher, so that we can place needles in the vein and we can obtain high blood speeds through the filter. Local anaesthetic cream is used before the needles are inserted. Some of our children insert their own needles. We offer play therapy to children who are afraid of the use of needles. The advantages of a fistula are that the vessels in the neck are preserved and the infection risk is reduced. Also there is less restriction on activities such as swimming. It is not possible to create a successful fistula if previous catheters have damaged the veins, which is why we like to use catheters as infrequently as possible. The fistula takes a while to become usable after it is created. This usually takes four to six weeks. For more detailed information about fistulae, please see our *Arteriovenous fistulae for haemodialysis* information sheet.



Frequently asked questions

Will my child stop passing urine?

Some children continue to pass urine even though their kidneys do not do all the other aspects of their work. They may even still pass a lot of urine and continue to need lots to drink. These are usually the children who have been born with abnormally formed kidneys. Other children may produce very little or no urine and need to have a limit on their fluid intake.

Will there be a limit on the amount of liquid my child can drink?

It is only possible to drink what can either be passed out as urine or what the dialysis can remove. In addition, a small amount of water is lost in faeces (poo) and in sweat. If your child passes lots of urine then they may not need a fluid restriction. However, most children will need a fluid restriction (allowance) each day, which we will prescribe for you. The size of the fluid restriction depends on how well fluid can be removed with peritoneal dialysis or how much fluid the child can tolerate being removed by haemodialysis in a relatively short time.

■ Peritoneal dialysis

If your child is not to retain fluid and gain weight, then what goes in has to equal what comes out. That is, the amount drunk must equal what the dialysis pulls off combined with the urine output. The concentration of sugar in the cleaning fluid varies, and high concentrations pull off more fluid. We will teach you all about this during your dialysis training.

■ Haemodialysis

If too much is drunk between dialysis sessions, then blood pressure goes up and the child can become very unwell, particularly as the fluid is removed during dialysis. They will also need to stay on the machine longer as the excess fluid may have to be removed separately at the end of the haemodialysis session.

Will they need a special diet?

Good nutrition is an essential part of your child's treatment. Your child may already have had some dietary changes before dialysis started. Our dietitian will continue to see you regularly and discuss any changes that would help your child's growth and well being. A low salt intake is needed in some children who only pass small volumes of urine, as salt will make the child thirsty. Salt and water will be retained making blood pressure go up. However, some babies and children who pass lots of urine may need extra salt.

■ Peritoneal dialysis

The amount of protein in the diet is increased because protein is lost in the cleaning fluid. If your child struggles to eat more protein, dietary supplements may be recommended. Some sugar is absorbed from the cleaning fluid, particularly if strong solutions are used, so the energy intake your child needs may also change.

■ Haemodialysis

Potassium levels may need attention if your child's urine output is low or if they are unable to achieve an adequate calorie intake. Individual



dietary advice will be given for your child. Often children will require dietary supplements to increase their calorie intake. If potassium levels are high with adequate calories, small changes to the diet will be suggested but we will make allowances for favourite foods.

Neither type of dialysis is very good at removing phosphate. Your child may need calcium carbonate to bind the phosphate in the gut before it is absorbed. If you are unsure which foods contain phosphate and how much your child should eat, please discuss this with your dietitian.

What checks will you be doing to make sure all is well?

The best check of how your child is doing is that they feel as good as possible and that their height is increasing appropriately. We can also do checks of dialysis adequacy, which we call Kt/V. This is a measure we can make using blood and urine. Blood pressure is very important and we also do blood tests, similar to those done before dialysis:

■ **Blood acidity (sodium bicarbonate)**

Usually the dialysis corrects this, so bicarbonate may be stopped before dialysis starts, although some children continue to need it.

■ **Urea**

When dialysis starts, it may be possible to be a little more flexible with the amount of protein in the diet as dialysis will remove some urea. Our dietitian will give advice about controlling the urea level if needed.

■ **Calcium, phosphate and parathyroid hormone (PTH)**

Getting rid of phosphate is a particular problem with dialysis. It can be very difficult to get rid of all the phosphate eaten. Phosphate is very bad for the bones and blood vessels. High levels of phosphate and PTH are a very important cause of cardiovascular disease. The mortality from this is about 700 times higher in young adult patients on long-term dialysis than in the normal population. This is why we are so keen to ensure that your child takes calcium carbonate and activated vitamin D and follows advice about phosphate intake to reduce this risk.

■ **Anaemia (haemoglobin and iron levels)**

If erythropoietin and iron were needed before dialysis, it is likely that they will need to be continued. However, we give iron directly into the vein during haemodialysis rather than by iron tablets.

What are the risks of dialysis?

Whenever there is plastic inserted into the body (central venous haemodialysis catheters and peritoneal catheters), there is a chance of them becoming infected. Also as the kidneys are working so badly, there is a risk of the blood potassium becoming high if care is not taken with diet, and this can make the heart rate abnormal. In the long term, there is a very high risk of cardiovascular disease, such as heart attacks and strokes, due to high phosphate, BP and PTH levels. There is a chance of death for children on dialysis, although this is low at about one per cent a year. There is also a chance of dying with a transplant, but overall the rate of death is lower.



How long can dialysis last?

The average length of time for peritoneal dialysis is five years, but in many children it can carry on for much longer. Haemodialysis can continue for as long as it is possible to access the blood circulation. However, as hardening (calcification) of blood vessels increases progressively with time on dialysis, we prefer to transplant children before dialysis is necessary if possible or as soon as possible after dialysis has started.

**If you have any questions,
please call Victoria Ward
on 020 7829 8815**

Notes

Compiled by the Nephrology department in collaboration with the Child and Family Information Group

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