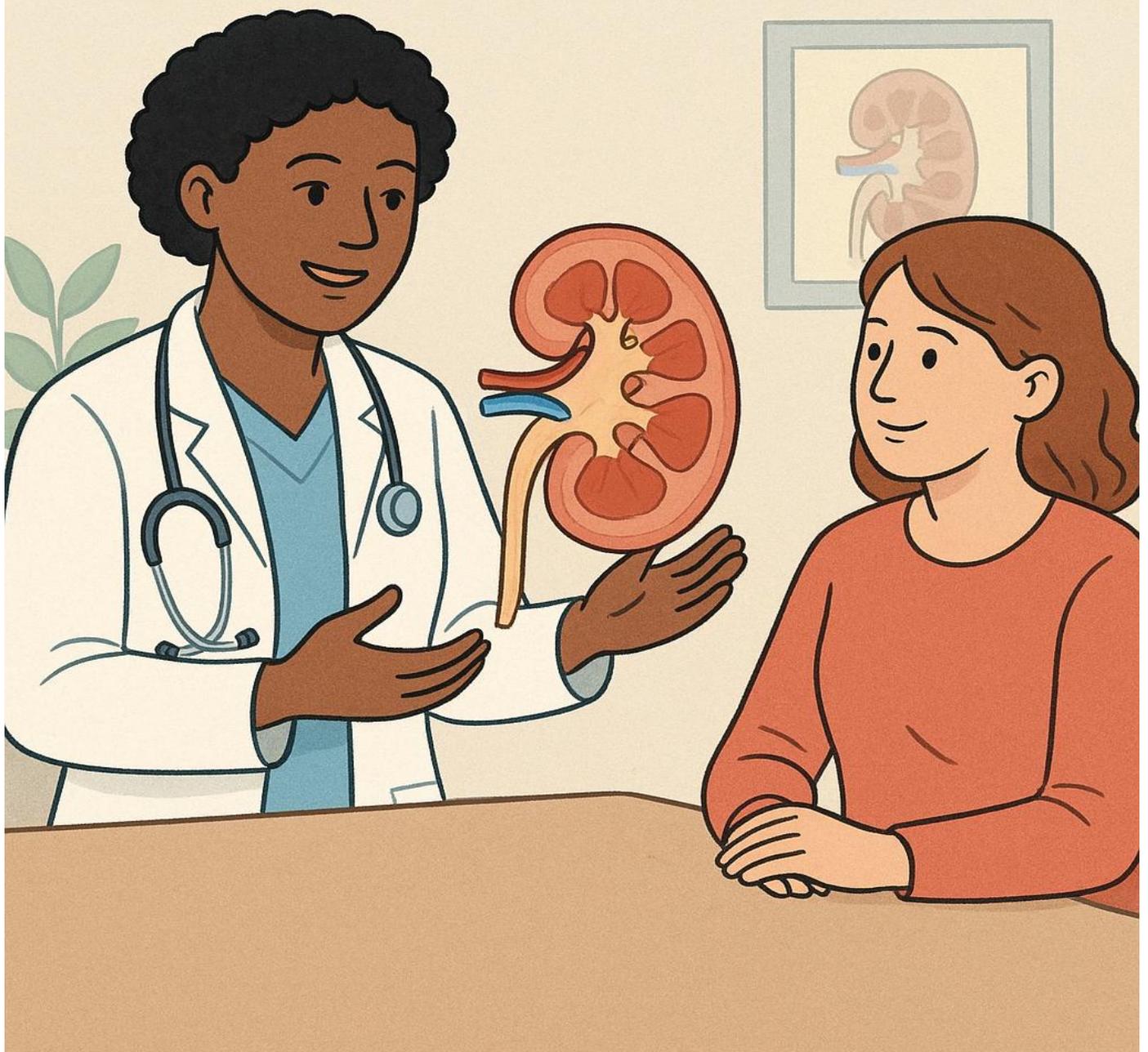


# UNDERSTANDING KIDNEY FAILURE

LEARNING AND GROWING TOGETHER

2025 EDITION



An Information booklet designed for patients and their families

© Renal Department, St George Hospital, 2025 updated

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## CHAPTER 1- THE KIDNEYS

The kidneys sit in the lower part of your back, one on either side of the backbone (see figure 1.). The 12th rib bone protects the upper part of the kidney. Between your kidneys and skin there is a layer of fat, some muscle and a capsule that surrounds the kidney. These layers ensure that the kidney is well protected when injury occurs.

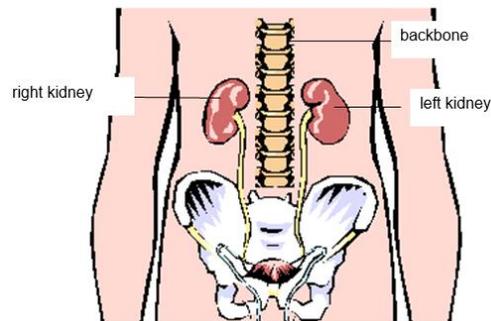


Figure 1. Shows the position of the kidneys on either side of the backbone.

Each kidney receives blood from an artery called the renal artery. The renal arteries branch off the major blood vessel in the body, the aorta. When the blood is cleaned (filtered) by the kidneys it is returned to the circulation by other blood vessels called the renal veins. These renal veins join the general circulation in a big vein called the inferior vena cava.

Each kidney is broadly divided into two areas. The outer part of the kidney is called the cortex and this is where most of the action takes place. It is within the cortex that the "nephrons" are found and the nephrons are the parts of the kidney which are responsible for filtering the blood.

The second major part of the kidney is the inner part, the medulla. The medulla is necessary for releasing certain hormones and for enabling us to concentrate the urine. Without a properly functioning medulla we would be passing urine all the time. (Figure 2.)

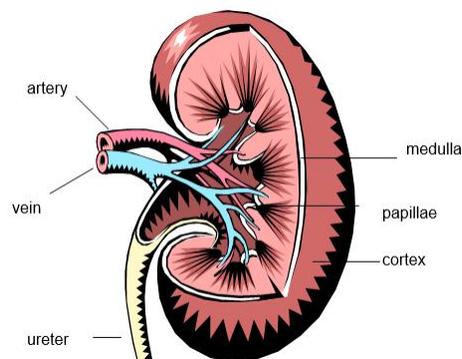


Figure 2. Shows the two main areas of the kidney

Once the blood has been filtered in the nephrons in the cortex, this filtrate goes through the medulla and any that needs to be reabsorbed back into the circulation is kept at that stage. What we no longer need passes out from parts of the medulla called papillae. These papillae are sometimes damaged in conditions like analgesic nephropathy and diabetes (see later).

By now urine has been formed and this passes down a tube called the ureter, which joins each kidney to the bladder. The urine remains in the bladder until it stretches sufficiently to signal our nervous system that it has to

be emptied. Urine is then passed from the bladder to the outside world via the urethra. The urethra is quite short in the female and much longer in the male as it runs the distance from the base of the bladder through the prostate and then through the penis.

### Functions of normal kidneys

The kidney has six major functions: -

**1.To excrete the products of protein breakdown.** Everyday our bodies break down some protein (protein is the main building block of muscles). These breakdown products are usually not a worry provided the kidneys can excrete them. The major product you may know of is called urea. When the kidneys do not filter very well we tend to retain urea.

**2.The kidneys need to regulate the balance between acid and base in the body.** The main base is bicarbonate, similar to baking powder. Any of you who have a swimming pool know that you have to keep the pH correct at all times. The pH is a reflection of your acid base balance and our blood system is like a giant swimming pool where we need to keep the pH constant at all times. The kidneys perform this function by excreting acid when they should and by generating more base when it is required.

**3.A very important function of the kidneys is to regulate the balance of salt and water in the body.** Normal kidneys can respond extremely quickly to the need for keeping salt in the circulation. An example of this occurs during hot weather when we sweat a lot or after a particularly stressful exercise such as running. Without normal kidneys we would rapidly become dehydrated and would collapse.

Conversely, the kidneys need to be able to excrete salt when the body does not need it. If you dine out at a Chinese restaurant then it is quite likely that you will ingest a lot of salt and under ordinary circumstances you will not need this. Your kidneys will excrete this salt and hence you will not get high blood pressure.

**4. Regulation of electrolytes.** There are certain substances in our bodies which regulate important functions such as contraction of muscles, the working of nerves and the contraction of the heart. The most important amongst these is potassium, for without a proper balance of potassium in the body, muscles will not work properly and with a build up of potassium the heart may stop! Calcium and phosphate are also important to ensure that our bones, muscles and heart all function as they should. The kidneys regulate the balance of these substances, and many more.

**5. It is often not appreciated that the kidney is like one big "gland". It produces a number of hormones and it activates a number of other hormones,** which are produced in other parts of the body such as the liver. Without the kidneys we would not have good function from hormones such as Vitamin D which is necessary to absorb calcium into the system and prevent bone diseases like osteoporosis. Another major hormone is called erythropoietin. This hormone sends a signal from the kidney to the bone marrow to tell our body to make more red blood cells, which carry oxygen and give us energy.

**6. Finally, the kidney has an important function to ensure that we remove medications that we take.** Medications are generally broken down by either the liver or kidneys and in either case the waste products from these medications often have to be excreted by the kidneys.

#### FUNCTIONS OF THE KIDNEY

1. Excrete products of protein breakdown.
2. Regulate acid-base balance.
3. Regulate the balance of salt and water in the body.
4. Regulates electrolyte balance.
5. Production of hormones.
6. Excretes medications to prevent their build up in the body.

## CHAPTER 2 - KIDNEY FAILURE

### Major causes of kidney failure in Australia

**Glomerulonephritis** ("nephritis") is a common cause of kidney failure. There is a range of types of nephritis but these can generally be thought of as an immune reaction against your own kidneys. In turn the kidneys leak blood and/or protein into the urine and gradually the nephrons get scarred. Once they get scarred they cannot do their filtering job properly and the kidneys begin to fail. Some types of nephritis are readily treatable with powerful medications. Others types remain untreatable and slowly progress towards kidney failure, usually over a 10-20 year period or more quickly in rare cases.

The most common cause of kidney failure is **Diabetes**. About one third of patients who have insulin requiring diabetes will develop kidney failure. This is more likely in patients with high blood pressure or where blood sugars are poorly controlled. This is commonly accompanied by eye problems as well. Recent studies have shown that very good control of blood sugar may prevent or delay the onset of kidney failure from diabetes. Some blood pressure medications are now known to also delay this process - therefore the news is not always bad for diabetics who start to develop kidney problems. The first sign of kidney problems in diabetes is the appearance of protein in the urine. This is easily tested for by a simple urine test.

**Reflux nephropathy** is a disorder that people are born with. In essence, the ureters did not develop properly and where they join into the bladder is faulty. When urine is passed some of it goes backwards up towards the kidneys as well as forwards into the outside world. This "reflux" back up into the kidneys gradually damages the kidneys, particularly if there is also urine infection or high blood pressure. Provided this condition is recognised in the first couple of years of life then surgery and/or antibiotics may prevent long term problems.

**Analgesic nephropathy** is kidney failure (kidney scarring) caused by the old analgesic powders which you may know as Bex or Vincent's. It is possible to develop a similar condition if you take a lot of medications used for the treatment of arthritis, or a lot of aspirin. This condition is becoming much less common since the powders were made illegal in the 1970s.

**Polycystic kidney disease** is responsible for about 10% of patients with kidney failure in Australia. This is a genetic (inherited) disorder which affects about 1 out of 2 family members. The inherited tendency is for very large cysts to fill the kidneys, resulting in kidney failure because there is not enough room for the nephrons to do their filtering. This condition is readily diagnosed by an ultrasound to see if the kidneys have been affected and generally if there are no cysts by age 30 then it is very unlikely that the condition will ever appear in that person. There is not specific treatment for polycystic kidney disease as yet, though certain blood pressure medications may be quite useful in this condition to slow the rate of decline towards kidney failure.

**Ischemic nephrosclerosis** is the name given to scarring of the kidneys which occurs because the blood flow to these kidneys is reduced. This is very similar to coronary artery disease or "hardening of the arteries" at any site in the body. This process arises due to a combination of factors such as a family history of hardening of the arteries, diabetes, high blood pressure, high cholesterol and smoking. It tends to affect older people and can be prevented by good lifestyle! This is becoming one of the most common causes of kidney failure in Australia and reflects our limited attention to healthy eating, exercise and blood pressure control.

There are a large number of other causes of kidney failure but these are fairly rare.

## The problems with failing kidneys

A quick check of the functions of the normal kidneys will suggest what goes wrong when the kidneys start to fail.

1. The products of protein breakdown get retained leading to nausea and lack of appetite and some weight loss.
2. There tends to be a build up of acid which can result in rapid breathing and disturb other functions in the body, including the reduction of bone strength.
3. As the kidneys decline they generally retain too much salt and water leading to high blood pressure and sometimes difficulty in breathing.
4. As the filtering ability of the kidney ceases potassium tends to get retained in the body and this can cause fatal heart rhythms if left unchecked. Phosphate is also retained and calcium falls and this leads to weakening of the bones and muscle aches.
5. The kidneys fail to produce a hormone called erythropoietin (EPO). This hormone tells the bone marrow to produce red blood cells and hence a deficiency of this hormone leads to anaemia. This in turn makes you tired and may cause palpitations, loss of libido and a general feeling of lethargy.
6. Failure to activate Vitamin D can result in bone disease and changes in other hormones can raise the blood pressure. Because the kidneys break down insulin, diabetics sometimes need to use less insulin than they did before the kidneys failed.
7. Finally, certain drugs may build up in the blood stream as the kidneys deteriorate and it is always worth checking your medications with your doctor. This particularly applies to the use of some blood pressure and heart medications which can build up if the kidneys fail or may even accelerate the problems of kidney failure.

Kidney failure can potentially affect the whole body. On the following page is a list of potential complications that can occur with kidney failure. As you can see many parts of the body may be affected. This list is not exhaustive but it is worth pointing out that individual patients will get different arrays of these symptoms. It should also be noted that the major aim of treatment is to prevent these complications from occurring as much as possible.

**Table 1 - Potential effect on the whole body**

<b>Nervous System</b>	Confusion; "vagueness"; reduced concentration ability Drowsiness; forgetfulness; headaches Subtle personality changes Coma (very rare these days) Peripheral neuropathy - tingling or loss of feeling in hands and feet.
<b>Muscles and Bones</b>	General weakness; muscle aches Bone pain Easy fractures of bone
<b>Blood System</b>	Anaemia - tiredness; loss of energy; heart palpitations, shortness of breath Reduced ability to fight infection Easy bruising Blood vessels harden more easily, i.e. "hardening of the arteries".
<b>Heart</b>	High blood pressure - usually causes <u>no</u> symptoms but may cause the heart to pump less effectively Angina - chest pains due to "coronary disease" Heart failure
<b>Lungs</b>	Rapid breathing and/or shortness of breath.
<b>Gastrointestinal System</b>	Nausea; vomiting; loss of appetite Diarrhea Stomach ulcers (peptic or duodenal ulcers) usually cause no symptoms but later on may cause stomach pains or may bleed.
<b>Skin</b>	Dry skin Itching Easy bruising Cuts do not heal so quickly
<b>Sexual Dysfunction</b>	Impotence - sometimes due to drugs used in treatment Loss of libido Infertility - most men do not produce normal number of sperm, and most women do not ovulate (however some do and contraception is still advised).

**The progressive nature of kidney failure**

Once mild to moderate kidney failure has progressed, it is usual for the decline in kidney function to continue. However, the rate of decline is quite variable i.e. some kidney disorders will progress more rapidly than others and within different patients even the same disorder might progress at a different rate. The end result is that some disorders will progress so slowly that they will ultimately not affect the patient's life span whilst others will progress very rapidly and dialysis and transplantation will be required fairly quickly.

The two aims of treatment in the early stages of kidney failure are:

1. To slow the rate of decline of kidney failure; and
2. To prevent as many complications of kidney failure as possible.

## Treatments to slow the decline in kidney function

Quite a lot of attention is paid to **changing your diet** once kidney failure becomes established. The main thrust is to ensure you are eating for a healthy lifestyle. Some studies have shown that a reduced protein intake may slow the rate of decline of kidney function but this should always be done in conjunction with an experienced dietitian as it is important not to reduce the protein intake too much thereby causing malnutrition.

Perhaps the most important way of slowing the rate of decline of kidney function is **meticulous control of blood pressure**. High blood pressure rarely causes symptoms but your doctor will still pay a lot of attention to your blood pressure and blood pressure lowering medications will constantly be altered.

Recent studies have suggested that **controlling cholesterol and other body fats** might also slow the decline in kidney function. Therefore you may be placed on a low cholesterol diet or even cholesterol lowering or other fat lowering medications.

It is very **important to avoid factors which might accelerate the decline in kidney function**. These include some drugs so it is always important to check any new medications with your doctor. This also applies to the use of “natural” remedies, some of which have been associated with rapid kidney failure. Becoming dehydrated at any time is not good for the kidneys and urinary tract and other infections should always be treated fairly early so you should see your doctor at the first sign of infection

## Assessment of kidney function

The simplest way of assessing your kidney's ability to filter the blood is by measuring the products of protein breakdown in the blood. These are called urea and creatinine (creatinine comes from muscle). The higher the result in the blood, the worse your kidneys filtering ability.

The estimated filtration rate or the eGFR is also a calculation reported on your blood tests which can help indicate the percentage of kidney function you have.

There are more sophisticated ways of assessing kidney function and on occasions these will be necessary e.g. nuclear medicine blood tests, 24-hour urine collection etc.

As well as assessing the kidneys' functions your doctor will wish to assess your kidneys' structure. This will mean x-rays and ultrasounds but on occasion more specialised testing such as a kidney biopsy will be needed. If these specialised tests are required your doctor will discuss the details of these with you.

By periodically reviewing blood tests (your doctor will determine how often this is necessary in your case) the rate of decline of kidney function can be assessed. Changes in the blood tests can often pre-date the development of symptoms of end-stage renal failure. Therefore these tests are very important and it will often be possible for your doctor to predict that dialysis is necessary before any major symptoms develop. In some cases, even with careful attention to the blood tests, the kidney function may decline rapidly towards the end and the most common symptoms at this stage will be nausea, vomiting and weakness.

## CHAPTER 3 - TREATMENT OPTIONS FOR END-STAGE KIDNEY FAILURE

When your doctor decides that dialysis is about to become necessary or alternatively, you have begun to develop symptoms and/or signs of end-stage kidney failure, then several new options become available. The "medical" treatments (e.g. diets, medications etc) may still be required in conjunction with these new treatments and you will be advised about this.

The treatment options fall into four groups: -

1. Haemodialysis
2. Peritoneal dialysis
3. Transplantation
4. Conservative treatment

The principle of any form of dialysis is that the blood is artificially filtered. In essence the blood runs on one side of a membrane (like a thin sheet of paper) and dialysate fluid (a man-made solution) runs on the other side of this membrane.

In haemodialysis this membrane is an artificial kidney manufactured by companies. In peritoneal dialysis the membrane is the peritoneum which is the natural lining of the inside of your abdomen.

**If dialysis is chosen as the most suitable option, dialysis at home is strongly encouraged. Patients who learn to perform their own dialysis at home generally have better health and a more independent lifestyle.**

### Choosing the type of treatment

This is an individual decision and on some occasions your doctor will strongly advise one form of dialysis because of other existing problems. However, where there is not any particular indication that one form would be better than another, the choice of home therapy is left to the patient.

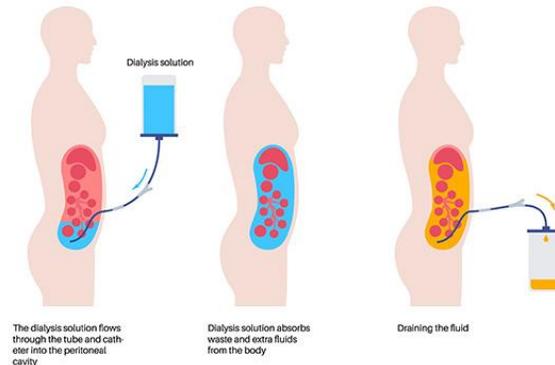
Juggling medications, perhaps dietary restrictions and certainly a healthy lifestyle are all important no matter what option you choose. Sometimes the decisions regarding what option is best for you are difficult especially for people who have little understanding of kidney treatments. Your healthcare team including your kidney doctor, nurse consultant, social worker, dietician, GP and others are available to assist you in your decision making.

At the end of the day it is important to bear in mind that dialysis will keep you well but that, like every treatment in medicine, there may still be complications.

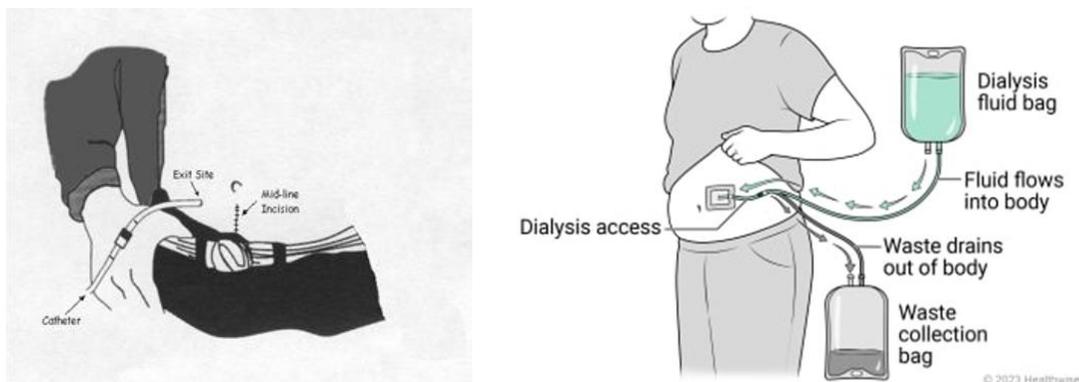
**All patients with kidney failure should consider planning for the situation where they may not be able to make their own decisions about the medical treatments they would like in the future. More information regarding this process can be found at the dialysis unit, through clinics or ask the Renal Social Worker for assistance.**

## Option - Peritoneal Dialysis (PD)

Peritoneal dialysis uses the **peritoneum**, a natural membrane lining the inside of your abdomen, to filter waste and excess fluid from your blood. This membrane has a rich blood supply and surrounds your abdominal organs, making it an effective natural filter or dialysis membrane.



To begin PD, a soft plastic tube called a **peritoneal dialysis catheter (PDC)** is inserted into your abdomen. This tube stays in place permanently and is covered with a dressing, which you will be taught to care for yourself.



There are two main types of peritoneal dialysis: **Automated Peritoneal Dialysis (APD)** and **Continuous Ambulatory Peritoneal Dialysis (CAPD)**.



In **CAPD**, dialysis fluid is introduced into your abdomen through the PDC. The PDC will be capped whilst the fluid stays inside for several hours, during which it absorbs waste and excess fluid from your blood. After about six hours, the used fluid is drained and replaced with fresh fluid. This process is done four times a day, with each exchange taking around 30 – 45 minutes. You can continue with your usual daily activities while the fluid is in place. However, it's important that each exchange is done with care and good hygiene to avoid infection.



**APD**, is done using a machine that performs the fluid exchanges automatically whilst you sleep, usually over 8 to 12 hours. This option is often more convenient for people with busy schedules, as it frees up your daytime hours.



Peritoneal dialysis gives you the flexibility to manage your treatment at home, offering greater independence and a gentler, more continuous form of dialysis.

## Option - haemodialysis

Haemodialysis involves the filtering of blood through an artificial membrane using a machine. Blood is withdrawn and circulates through the artificial kidney or dialyser and is then returned to the patient.

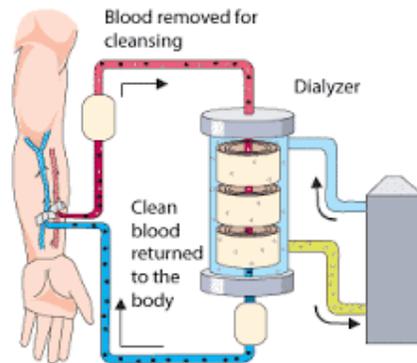


Figure 5. Haemodialysis Process

Before haemodialysis can be commenced it is necessary to gain access to the patient's blood stream. This will require an operation to create an AV fistula. During an AV Fistula operation the surgeon makes an opening in the wrist or elbow and connects one of your veins to your artery. The wound is then closed with internal sutures.

After the operation your vessel begins to enlarge under the skin and when you place your fingers over the area a buzzing (thrill) can be felt after 6-8 weeks these veins become suitable for the placement of needles required to withdraw and return the blood to your body during haemodialysis. (See figure 5.)

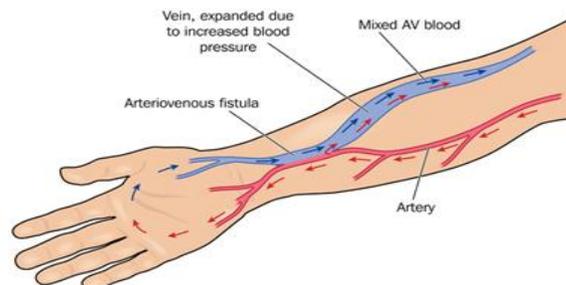


Figure 6. An AV fistula created in the arm. The artery and vein are stitched together and the blood from the artery flows directly into the vein making the vein stronger.

The Vascular Access Nurse (VAN) will arrange you to have ultrasounds of your vessels before you see the surgeon. The VAN will also follow you up post operatively to ensure your fistula is developing well. Although it sounds somewhat frightening at first, most patients learn to put their own needles in and become extremely good at this. The process of haemodialysis usually takes 5 hours and is done at least 3 times per week.

### What are the benefits of Home Haemodialysis?

- Home haemodialysis makes it possible for you to remain independent of hospital care, rigid routines, a “sick” environment and the risk of cross infection.
- Home haemodialysis permits flexibility with days or hours for dialysis treatments and can be done while asleep, leaving the days free for work, school and play.

- Our data from quality of life surveys repeatedly identifies home haemodialysis as the dialysis option which promotes the best quality of life.
- Home haemodialysis provides the opportunity for successful rehabilitation and continued employment.
- Time, money and difficulties in arranging transport are saved by not having to travel to dialysis units three times every week.
- Home haemodialysis comes with good follow up support in the home by trained staff.
- You should experience fewer problems with your fistula because the same person puts the needles in each time.
- Good for patients who are remote from hospital as home haemodialysis requires people to only come to hospital for clinic visits.
- You can perform home haemodialysis if you live alone.

### **But most of all home haemodialysis offers flexibility and improved quality of life**

Because you are at home you are not restricted to the usual three times a week dialysis for a set number of hours. Many home haemodialysis patients now dialyse every second day or overnight. Longer hours of dialysis means better clearance of waste and fluids from your body. Kidneys normally work 24 hours a day therefore longer and/or more frequent dialysis will make you feel better, stronger and reduce the restrictions and medications you may otherwise have.

### **What are the benefits of more frequent & longer dialysis?**

- Dialysis related symptoms e.g. lethargy, post dialysis headaches, cramps etc are rare
- Better fluid control with reduced restriction on fluid intake
- Better nutritional status with reduced restriction on foods that contain potassium and phosphate
- Less sleep disturbances
- Less medication required e.g. blood pressure and phosphate binders
- Sexual desire and activity is improved
- General physical, mental and long term health outcomes are improved.

St George Fresenius Medical Care home haemodialysis training is a satellite of Sydney Dialysis Centre (SDC) based at Royal North Shore Hospital. People are required to go to SDC for an interview and the final part of training but the majority of the training can be done at St George Fresenius Medical Care. Usually training will take an average of 10-12 weeks. The duration of the training is very individual, so the time frame is tailored to each patient. When you are reaching the end of the training you will be transferred to SDC where you will have dialysis in the graduation room. This simulates the home environment to ensure you are confident and safe to start dialysis at home. You will meet the SDC nurses who will provide the 24 hour on call service to you and will visit you at home to monitor your progress and ensure your dialysis is trouble free.

We have around 50 patients who perform haemodialysis treatment at home. In total SDC cares for approximately 150 patients on home dialysis. Most patients do 5-6 hours every second day. About 25% of the patients perform nocturnal (at night) dialysis for 8-10 hours. Approximately 35% of the patients perform dialyse solo (without any support from family or friends).

### **Who is suitable to do home haemodialysis?**

People who have:

- Motivation to succeed and are self reliant at home
- Good eyesight & hand dexterity
- The ability to understand the concepts of home haemodialysis

- Good vascular access (fistula or graft)
- Space at home for equipment
- Good general health, memory, alertness and mobility.

### **Option - kidney transplantation**

A kidney transplant is one of the alternatives for treatment of kidney failure. Recipients of successful transplants generally feel significantly better, and their lifestyle is usually more reminiscent of that before they developed kidney problems. The results for kidney transplantation within Australia are comparable to the best in the rest of the world. According to the most recent figures, approximately 90% of the transplants performed in this country still function at the end of one year, and 95% of the recipients are still alive. The corresponding figures after five years are around 75% and 85% respectively. Nevertheless, there are some risks involved in kidney transplantation, and recipients face a lifetime of taking powerful drugs that suppress the function of the immune system. The following brief description is designed to answer a number of the common questions about transplantation.

### **Who can have a kidney transplant?**

Not everyone is a suitable candidate for a kidney transplant. The presence of conditions such as chronic infection, cancer or serious heart or lung disease makes some people unsuitable candidates for renal transplantation. This is because these conditions substantially increase the risk of postoperative complications or prevent the use of transplant medications which work by suppressing the immune system. While age is not the primary consideration in whether a person is suitable for a transplant, the increased risk of conditions such as heart disease as patients get older means that in practical terms many patients older than the age of 60 are not suitable candidates for a renal transplant. However, the decision about whether a patient is suitable for a transplant is made on an individual basis after assessment by the patient's renal physician in consultation with the transplant physician.

### **What are the benefits and risks of kidney transplant?**

The most obvious short-term benefit of a kidney transplant is the freedom from dialysis and a dramatic increase in spare time. Following recovery from the operation, most recipients also feel much better, and many are able to return to full-time work. Usually the only restriction on activities is to avoid contact sports, rather than run the risk of injuring the transplanted kidney. In most cases recipients also experience improved sexual function and interest, and most women of childbearing age will regain their fertility. There have been many examples of successful pregnancies following transplantation, so contraceptive precautions are required once again.

These benefits do not come completely free of risk. The initial risk is of the operation itself, and surgical complications are not uncommon, but are usually minor or easily fixed. The major long-term risks are secondary to the immunosuppressant drugs that are necessary to prevent the body from rejecting the transplant. There is an increased chance of infections, some of which can be life threatening. Hence, we advise all recipients to take precautions to avoid exposure to people with infections, especially in the first few months following the transplant, and during this time they are seen very frequently and assessed carefully by the transplant doctors. This is also the time when rejection of the transplant is most likely.

Treatment of rejection requires bigger doses of the drugs or more powerful medications and so is a particular time when infections can occur. Treatment with immunosuppressant medications also puts the recipients at increased risk of certain forms of cancer, particularly skin cancer.

We advise precautions against excessive sun exposure, and arrange regular review by a dermatologist. Women are also at increased risk of gynaecological cancers (e.g. cervical) and need to have a formal gynaecological examination at least annually.

There is a further long list of potential side effects of the immunosuppressant medications which will not be described here. It is important to be aware that every effort is made to minimize these problems particularly by reducing the doses of the drugs to the lowest level required to prevent rejection of the transplant.

### **Where do the kidneys come from?**

Most kidneys transplanted in Australia come from cadaveric donors i.e. victims of motor vehicle accidents or other catastrophic events that have been declared brain dead. This is also the source of other transplanted organs, such as livers, hearts, lungs, and pancreas. The Red Cross coordinates kidney allocation. When a donor is identified the body is maintained on a mechanical ventilator until the transplant surgeon removes the kidneys, which are then transported to the recipient's hospital packed in ice. Kidneys stored this way are useable for up to 36 hours, although sometimes recovery of kidney function may be delayed for several days or weeks after surgery. During this time the recipient is kept on dialysis until the new kidney takes over.

Approximately one third of kidney transplants in Australia now come from living donors, most of whom are close blood relatives of the recipient (e.g. parent, sibling). This is particularly common in children with renal failure, where one parent is the donor. Occasionally donation by a non-related person is considered, but only if that individual has very strong emotional ties to the recipient e.g. spouse, stepparent. There must be no question of inducement to donate a kidney. The risks to the donor include that of the operation, and probably a slight long-term increased risk of high blood pressure. However, one normal kidney is ample for good health and the donors generally consider that these small risks are comfortably outweighed by the potential benefits to the recipient. The long-term survival of well-matched living donor kidneys is excellent. Potential living donors undergo a careful screening procedure including a medical history, physical examination, blood and urine tests and X-rays to ensure their suitability for kidney donation.

### **How are the kidneys allocated?**

At the time of entry on the transplant waiting list all patients have their blood type and tissue type determined by the Red Cross. When a cadaveric kidney becomes available, it is allocated to the person on the waiting list with the best matching of both blood and tissue type, provided that they do not have a positive cross-match. If there is more than one suitable recipient, the kidney goes to whoever has been waiting the longest.

The current average waiting time for a kidney transplant in NSW is 4-6 years, and the waiting list continues to grow. The major problem is the low rate of organ donation in this country compared to the rate in other countries, particularly in Europe.

### **Option – Conservative management – choosing not to have dialysis**

For people with chronic kidney disease there is no specific pill or operation. In other words there is no cure. For some the disease will progress to a stage where treatments such as dialysis and or transplantation are recommended; for most the condition will still progress but at a slower rate.

Providing you with information about treatment options early in the course of kidney disease allows you the time for it all to sink in. There will be time to gain information about the dialysis options and about what it might be like if you decide not to take up dialysis. You can decide not to take up dialysis. You have the right to refuse treatment you do not want. It is preferred that this decision is informed which means you have an understanding of the other treatments and what they entail. Making decisions is a way that patients exercise their right to be involved in their health care.

There is information your kidney doctor can use to assist you in your decision. As you can imagine your other significant diseases and your age will impact on your future health no matter whether you choose to proceed with dialysis or not.

It is a good idea to involve family, friends and carers in your decisions as it will also affect them and the healthcare team encourages that to happen. Occasionally, patients and family members have unrealistic expectations about what dialysis can achieve. Dialysis is not a 'cure' for kidney disease. Ultimately it is your decision as to what you want to do about treatment for your kidney disease.

### **What symptoms might I experience and how can they be managed?**

Everyone is an individual and they respond to kidney disease in different ways. Most patients will report an increase in tiredness and inability to do the physical activities they once could manage. You may also experience emotional changes, appetite changes, itchiness, and changes in breathing and fluid accumulation.

### **Support at St George Hospital**

Some patients think that if they choose the 'no dialysis' option they will be abandoned by their kidney doctor and healthcare team. Sometimes patients have been visiting their kidney doctor regularly for a number of years and if you choose not to have dialysis you will continue with these visits.

At St George Hospital we pride ourselves on the support we provide for people who choose not to have dialysis. Our focus has always been on the quality of life and the journey of our patients. Arising from our endeavours are a number of initiatives but the most exciting is the Renal Supportive Care Clinic.

The strong partnerships we have forged with the palliative care service at the hospital have allowed us to use the expertise of these doctors and nurses to help in kidney failure management. The service is crucial in controlling and supporting patients with symptoms and when the time comes - end of life care. Your kidney doctor may refer you to this clinic to help you with your decision regarding whether or not to have dialysis or to assist in controlling your symptoms if you choose not to have dialysis. Remember you will still continue to see you kidney doctor regularly.

## CHAPTER 4 - NUTRITIONAL MANAGEMENT

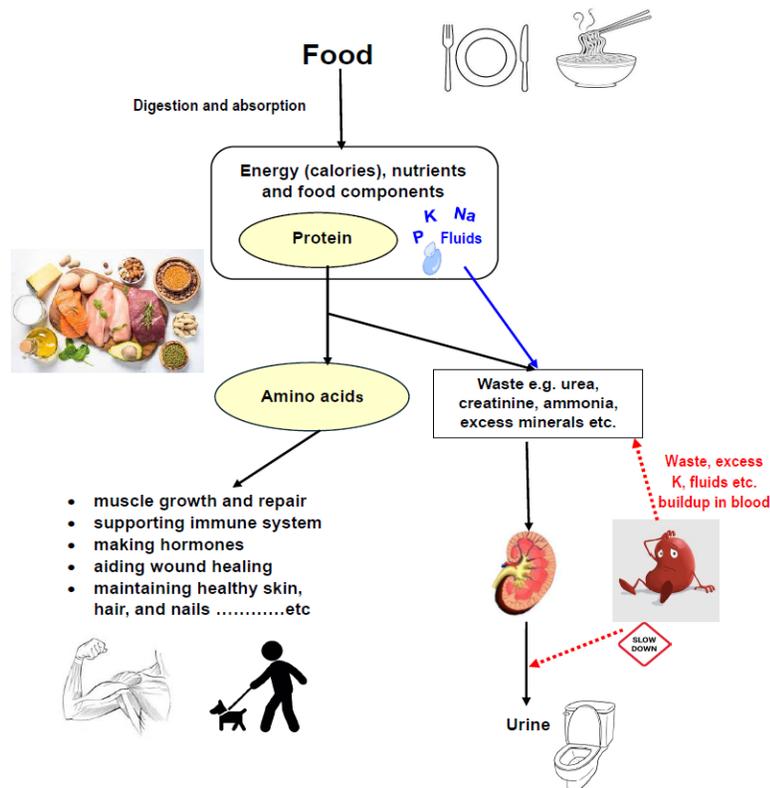
### Why Nutrition Matters When You Have Kidney Disease

Eating well is an important part of looking after your kidneys. Along with your medications, regular exercise and a healthy lifestyle, good nutrition and special diets can help you feel better and stay healthy.

#### Food and Your Kidneys

Food and drinks give your body energy and important nutrients like protein, vitamins, minerals, and other components such as dietary fibre, probiotics and antioxidants. These help your body work properly.

After your body uses what it needs, it creates waste products like urea, creatinine, and ammonia. Your kidneys normally remove these waste products from your blood and pass them out in your urine. But if your kidneys aren't working well, these wastes can build up in your blood. This can cause symptoms like nausea (feeling sick), changes in taste, feeling tired etc. Your kidneys also help balance minerals and fluid in your body. When they're not working properly, fluid and minerals like sodium (salt), potassium, phosphorus can build up to unsafe levels. This can be harmful to your health and may affect your heart, bones, and muscles.



#### What a Renal Dietitian Does

A renal dietitian is a specialist who helps people with kidney problems eat the right foods. Their role includes:

- Giving you advice and education about food and nutrition.
- Helping you understand **what** and **how much** to eat, with practical tips.
- Creating a personal meal plan that suits your health needs.
- Checking in regularly to make sure your nutrition needs are being met.

## Special Diet Considerations to your Kidney Health

When your kidneys aren't working properly, they can't keep your body's systems in balance. This means you might need to change your diet to help your body stay healthy.

The goals are:

1. To keep your body well nourished: so your body gets the energy (calories) and nutrients it needs.
2. To help you feel better and safe by choosing the right foods.
3. To keep the blood levels of nutrients, waste and fluids in a healthy range to avoid problems – now (short-term) and in the future (long-term).

The type of diet you need depends on your kidney condition and how advanced it is. As your kidney function changes, your diet may need to change too – sometimes more than once before starting dialysis. It will also change again if you begin dialysis or have a kidney transplant.

Everyone is different, so your diet will be tailored to you. Things like your age, gender, weight (body size), how active you are, what you usually eat, eating habits, and other health conditions (e.g. diabetes) all need to be considered when planning your nutrition.

### Special Nutrition Considerations

**Protein** – Your body needs protein from foods like meat, fish, seafoods, chicken eggs, milk, legumes and nuts for many important jobs. How much protein (and energy/calories) you need depends how well your kidneys work and if you are having treatment like dialysis.



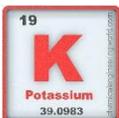
It's important to have enough protein without causing too much protein waste to build up.

- Good nutrition
- Prevent muscle loss



- Less build-up of harmful waste in the blood
- Reduce burden of the kidneys

**Sodium (Salt)** is made of sodium chloride. Your body needs a small amount of salt every day. Sometimes your doctor may ask you to eat less salt. This can help control blood pressure and reduce thirst, especially if you need to manage fluid or swelling.



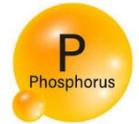
**Potassium** is an important mineral found in many foods, including fruits, vegetables, meat, milk, legumes, and other protein-rich foods. It plays a key role in helping your muscles and nerves function properly.

Having too much or too little potassium in your blood can be dangerous. High levels may lead to an irregular heartbeat or even a heart attack, while low levels can cause muscle weakness and other health issues.

Depending on your kidney function, medical treatments (like medications and dialysis) and body conditions (such as constipation, diarrhoea and changes in metabolism), you might need to follow a diet that is either high or low in potassium to keep your body's levels balanced.

***It's important not to restrict potassium on your own unless your doctor or dietitian asks you to. Doing so without proper advice can be harmful to your health.***

**Phosphorus** is an essential mineral found in many foods, including meat, milk, dairy products, legumes, and other protein-rich foods. It helps your muscles work properly and keeps your bones strong.



If you have advanced kidney disease, you may need to follow a low-phosphorus diet and take phosphate-binding tablets. These help prevent a build-up of phosphorus in your blood, which can upset the calcium balance in your bones and make them weaker.

Too much phosphorus in the blood can also cause itching and hardening of the blood vessel walls. These effects can be harmful to your overall health.

**Fluids** are important for keeping your body well hydrated. However, if you have problems like oedema (swelling), you may need to limit how much fluid you drink. Having too much fluid in your body can raise your blood pressure. This can happen if your kidneys aren't working properly and can't remove extra fluid, or if you have certain heart conditions that cause your body to hold onto fluid.

So, what counts as fluid? It's not just water or drinks. Anything that is liquid at room temperature is considered a fluid. This includes:

- Water, juice, soft drinks, tea, and coffee
- Ice and ice cream
- Sorbet and custard
- Soup and gravy
- Foods with high water content, like watermelon or oranges



### **Vitamins and minerals**

Kidney disease can affect how your body uses the vitamins and minerals from the food you eat. In some cases, your doctor may prescribe supplements, like iron tablets to treat anaemia or vitamin D to help keep your bones strong.

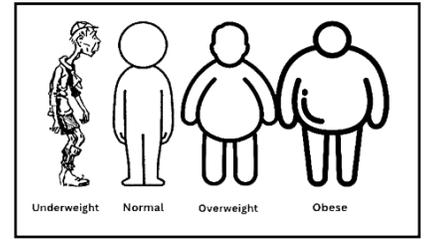


If you're on dialysis, you may also need extra vitamins to replace those lost during treatment. But be careful, taking unnecessary or large amounts of vitamins and minerals can be dangerous. When your kidneys aren't working properly, they can't remove excess, which can lead to harmful build-up in your body.

Only take supplements if your doctor or dietitian recommends them and aim to get most of your nutrients from a healthy, balanced diet.

## Healthy Weight

Keeping your weight in a healthy range helps control your blood pressure and blood fats, like cholesterol and triglycerides. If you're overweight, losing weight can be beneficial, being overweight or obese can directly harm your kidneys. It's especially important to avoid carrying too much fat around your waist, as this increases the risk of heart problems.



When your kidneys aren't working properly, waste builds up in your body. This can lead to a loss of appetite, nausea (feeling sick), dry retching, or changes in how food tastes. As a result, you might eat less and lose weight without meaning to, which can lead to muscle loss, a sign of undernutrition.

### Nutrition Goals and Key Considerations:

Common goals for all stages of kidney disease and treatment are:

- Stay well and feel well
- Keep a healthy body weight, with strong muscle and less fat around the waist
- Avoid complications, like electrolyte and fluid imbalances, and heart or blood vessels problems
- Prevent malnutrition
- Maintain a good quality of life

General dietary considerations for all stages and treatment

- Keep blood pressure under control
- Eat a healthy, balanced and adequate diet
- Follow kidney- and heart-protective eating- this means limiting salt, unhealthy fats, and highly processed foods, while including plenty of fruit, vegetables, whole grains, and healthy proteins

### Specific goals and key considerations or various stages of kidney disease and treatments:

<p>Early to moderate CKD (Stage 1-3), kidney function &gt;30%</p>	<p><b>Goals:</b></p> <ul style="list-style-type: none"> <li>- Slow down kidney disease progression</li> </ul> <p><b>Special considerations:</b></p> <ul style="list-style-type: none"> <li>- Healthy eating to protect your kidneys and heart</li> <li>- Eat a moderate amount of protein food to reduce burden on the kidneys</li> </ul>
<p>Advanced CKD (Stage 4-5), Kidney function &lt;30%</p>	<p><b>Goals:</b></p> <ul style="list-style-type: none"> <li>- Slow down kidney disease progression</li> <li>- Delay the need for dialysis</li> <li>- Prepare for healthy start to dialysis (if for dialysis)</li> <li>- Manage symptoms like nausea (feeling sick), taste changes, poor appetite, dry retching / vomiting, constipation, sore or dry mouth, feeling full quickly</li> </ul> <p><b>Key considerations:</b></p> <ul style="list-style-type: none"> <li>- Continue kidney- and heart- protective eating</li> <li>- Eat <u>moderate protein</u> and enough calories to reduce kidney strain and waste build-up</li> <li>- Manage electrolytes imbalance (e.g. potassium, phosphate) if needed. <u>DO NOT restrict</u> your diet unless is needed as this can cause nutrition deficiencies</li> <li>- Control fluids if swelling or fluid overload occurs</li> <li>- Prevent malnutrition: reduced appetite is common and can lead to</li> </ul>

	<p>dietary deficiency and muscle loss</p>
Dialysis	<p>Dialysis helps but doesn't fix everything, so you may need to adjust your eating to feel your best</p> <p><b>Goals:</b></p> <ul style="list-style-type: none"> <li>- Eat well to support your metabolism and nutrient balance</li> <li>- Replace nutrients lost during dialysis</li> </ul> <p><b>Key considerations:</b></p> <ul style="list-style-type: none"> <li>- Follow a heart-friendly diet</li> <li>- <u>Eat more protein</u> to make up for losses during dialysis</li> <li>- Most people on dialysis don't pass much urine, fluid control may be needed</li> </ul>
Transplant	<p>A successful kidney transplant restores kidney function, so strict diets are no longer needed. However, medication side effects and food safety become important. There are 2 phases after transplant:</p> <ol style="list-style-type: none"> <li>1) <u>Acute phase</u> (first 3-6 months) when on "higher" dose of immunosuppressive medications</li> <li>2) <u>Maintenance phase</u>: on lower, ongoing doses of medication</li> </ol> <p><b>Goals:</b></p> <ul style="list-style-type: none"> <li>- Eat well to manage immunosuppressives medication side effects (e.g. weight gain, risk of diabetes)</li> <li>- Keep your new kidney healthy</li> </ul> <p><b>Key considerations:</b></p> <ul style="list-style-type: none"> <li>- Continue kidney- and heart- protective eating</li> <li>- Follow strict food hygiene to avoid infections</li> </ul>
<p>Conservative Care</p> <p><i>(For people not choosing dialysis or transplant)</i></p>	<p><b>Goals:</b></p> <ul style="list-style-type: none"> <li>- Slow down kidney disease progression</li> <li>- Preserve kidney function</li> </ul> <p><b>Key considerations:</b></p> <ul style="list-style-type: none"> <li>- Follow kidney- and heart- protective eating</li> <li>- Eat moderate protein food and enough calories to reduce kidney strain</li> <li>- Manage symptom</li> <li>- Prevent malnutrition</li> <li>- Set realistic goals, some people may prefer more flexible eating at very advanced stages</li> </ul>

## What is a Healthy, Balanced and Adequate Diet for Kidney and Heart Health?

A healthy, balanced diet gives your body enough energy (calories), protein, and all the essential vitamins, minerals, and other helpful nutrients, like antioxidants, gut-friendly probiotics, and dietary fibre. Eating the right types and amounts of these foods can help your kidney and lower your risk of heart disease. If you need to watch your intake of potassium, phosphorus, fluids, or have other health conditions like diabetes, your dietitian can help you choose the right foods from each group.

Food Groups	Types and amount	
Bread, cereals & grains	5 serves or more each day choose wholemeal and whole grains options	
Fruit & vegetables	Eat 2-3 servings of fruit and 5 servings of vegetables each day. The more colour, the better!	
Meat and meat alternatives	Amount depends on your weight, kidney stage and treatment. Choose lean meat, skinless chicken, oily fish, and plant-based proteins like legumes, nuts, and seeds.	
Milk and dairy	Amount depends on your weight, kidney stage and treatment	
Fat/oil	Choose healthy fats such as olive oil and seed oils	
<b>Other foods</b>		
Salt and salty foods	Limit intake as they can raise your blood pressure and cause your body to hold onto extra fluid.	
Sugars	It is very important to eat enough if you need more energy (calories)	
Alcohol	Limit intake as it can affect blood pressure control	
Ultra-processed foods	Avoid these foods as they often contain chemicals that are bad for your kidneys, heart, and general health.	

## CHAPTER 5 - MEDICATIONS

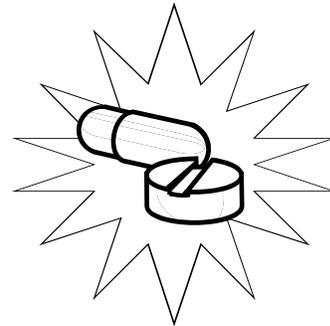
All of us need to know some basic facts about the medicines we take, whether for long-term use or short-term use, e.g. a course of antibiotics.

Prescribed medicines should be properly labeled with: -

- Name and strength of the medicine
- The amount to be taken.
- How often to take it.
- Any special instructions e.g. with or before food, avoid alcohol etc.
- Quantity in container.
- Patient's name.

### Side Effects

- All medicines have possible side effects.
- Not everyone experiences side effects.
- Different people can experience different side effects.
- If you experience any unwanted effects tell your doctor.



### Storage

- Store medicines in a cool, dry place, safe from children.
- Some medicines have to be refrigerated.
- Check expiry dates.
- Do not remove from original packaging.

### DON'TS

- Don't take more than your prescribed dose.
- Don't take someone else's medicines.
- Don't leave the doctors' surgery without fully understanding the instructions.
- Don't stop taking a prescribed medicine because you feel better.
- Don't stop taking your medicine because of a minor side effect - talk to your doctor or pharmacist.
- Don't stop taking your medicine because you feel it is not doing any good - talk to your doctor.
- Don't take leftover medicines without talking to your doctor.
- Don't be afraid to ask for more information or help in managing your medications.

## CHAPTER 6 - THE RENAL DEPARTMENT

The St George and Sutherland Hospitals are part of the South Eastern Sydney Local Health District. Since its inception in the 1970s, the St George Hospital Renal Department has rapidly developed into a service with dialysis and transplant outcomes as good as other major Teaching Hospitals in Australia.

The Department offers a wide range of services for people with kidney problems. These include:

- Peritoneal dialysis training
- Haemodialysis home training at St George Fresenius Medical Care
- Haemodialysis satellite with two units Sutherland and St George
- Renal transplantation preparation and follow up
- Blood pressure monitoring
- Clinics
- Laboratory and research facilities

**4 SOUTH** - Situated on the 4th floor of the Ward Tower Block, 4 south is the dedicated ward for patients requiring admission for kidney failure and related disorders. Visiting hours on 4 South are restricted to allow patients adequate rest.

**4 WEST** - 4 west houses the acute inpatient haemodialysis services. Patients who are in hospital have haemodialysis treatments on 4 west. Some patients who require haemodialysis are elderly or have medical reasons why they cannot perform dialysis at home or in a satellite unit. This group of patients also attend 4 west.

**HOME HAEMODIALYSIS** - St George Fresenius Medical Care is the place where people train to perform haemodialysis at home. There are around 40 St George patients who are performing home haemodialysis.

**THE PERITONEAL DIALYSIS-TRAINING UNIT** is located in a house in South Street Kogarah between the public and private hospitals. Specialist nurses are available for the training and follow up of patients on peritoneal dialysis. It usually takes about two weeks to be able to do your dialysis well. Following training the nurses visit on a regular basis, and then less frequently as time progresses. Peritoneal dialysis patients are required to attend the centre for review by their doctor at special clinics.

**SUTHERLAND SATELLITE UNIT** -This service is located within the grounds of The Sutherland Hospital. Patients who are unable to perform home haemodialysis attend this unit if there is a position. There is minimal nursing supervision and patients are expected to perform self-care where able.

**ST GEORGE FRESENIUS MEDICAL CARE** - This service is located within Kogarah. Patients who are unable to perform home haemodialysis attend this unit if there is a position. There is minimal nursing supervision and patients are expected to perform self-care where able.

**SYDNEY DIALYSIS CENTRE** – Located on the grounds of Royal North Shore Hospital, SDC oversees the home haemodialysis training conducted at St George.

## CHAPTER 7 - THE IMPACT ON YOUR LIFE

### THE DIAGNOSIS

The diagnosis of kidney failure can be a frightening and difficult experience for you and those close to you. The implications of kidney disease and its treatment may seem overwhelming.

Each person reacts differently to a diagnosis of kidney failure however it is likely that you will experience a range of feelings. Some of these may include:

- Shock and denial - "This cannot be happening to me. There must be some mistake"
- Anger, resentment and frustration - "Why me? I'm too young"
- Numbness and fear - "What's going to happen to me? Am I going to die?"
- Distress and depression - "I can't cope. What's the point anyway?"

All these reactions are normal. You need time to work through your feelings. It is often helpful to talk with family, friends or a social worker. You do not need to go through this alone.

### LIFE STYLE CHANGES

Although kidney failure will affect different people in different ways, it is likely that most people will have to make some adjustments or changes to their lifestyle to manage kidney disease and its treatment. Some of these may include:

- Less time for usual activities due to the treatment routine.
- Dietary and fluid restrictions, which may make socialising seem difficult.
- Increased dependence on family and/or friends
- Role changes within the family
- Reduction in the ability to participate in sport or other strenuous activities.
- Need to change or cease employment and possible financial stress that may follow.
- Decreased interest in sex.
- Change in body image.

These adjustments or changes are stressful for you and for your family. You may feel quite depressed in response. It is extremely important that you are able to share how you are feeling and seek support as needed. Once again, this is a normal response to a very difficult situation.

### IMPACT ON THE FAMILY

Kidney disease affects your partner, family or significant others as well as you. As such, it is likely they too will experience a range of feelings following your diagnosis.

Each family member will deal with their feelings differently. Some may not want to talk at all while others may have strong outbursts of emotion. This can create significant tension within the home. Although it is difficult it is important for family members to be sensitive to each other's needs as far as possible. Facing kidney disease together will make things easier.

Where open, honest communication can be achieved it allows for the expression of fears, anxieties etc. It also provides the opportunity for mutual support, which is much needed when facing a disease such as kidney failure. This is not always possible however as not all families are able to be sharing and supportive, particularly at such a difficult time.

It may be helpful to seek additional support from extended family, friends or from the team in the Renal Unit, particularly the social worker.

## THE SOCIAL WORKER

The social worker can provide you, your family and friends with both practical and emotional support. This may be on issues such as:

- Physical and emotional implications of your illness
- Body image and sexuality
- Adjustment to illness or loss
- Managing at home
- Relationship problems
- Financial matters
- Accommodation/housing
- Social security
- Arranging community support services
- Providing information on services/referrals and any other personal, relationship or family matters you wish to discuss

## RESOURCES FOR THE RENAL PATIENT AND FAMILY

**Kidney Health Australia** is Australia's voice for kidney disease, fighting for increased awareness, early detection and better treatment of this incurable disease.

A non profit that's advocating for urgent change and more focused research while being a life-long support for people living with kidney disease at every stage of their journey.

<https://kidney.org.au/>

**Kidney Health New Zealand** was Founded in 1979 as the National Kidney Foundation of NZ, this non-profit organisation.

What is the role of Kidney Health New Zealand?

- Provide education and support in the recognition of the symptoms of kidney disease.
- Provide resource information concerning the treatment and management of patients with kidney disease.
- To coordinate, advocate for and where possible, fund research into the prevention, early detection and cure of kidney disease.
- To promote the donation of kidneys and other organs and tissue for transplantation.
- Liaise with and support patient Support Groups

<https://www.kidney.health.nz/>

**Agency for Clinical Innovation - The Renal Network** is made up of clinicians (doctors, nurses and allied health professionals), health managers and consumers (patients and care partners) working together to improve the delivery of renal healthcare in NSW.

We work on several areas of inpatient and outpatient renal healthcare.

- Treatment options and pathways (dialysis, conservative kidney management & transplant) for kidney failure
- Acute renal care
- Kidney supportive care for stage 4 and 5 patients on any pathway with symptoms and/or suffering
- Tailored services for all renal units, regardless of size and location
- Children transitioning to adult renal services
- Aboriginal and Torres Strait Islander renal health
- All aspects of renal disease, such as glomerulonephritis, genetics and prevention

## CHAPTER 8 - USEFUL CONTACTS

	ADDRESS	PHONE
St George Hospital	Gray St Kogarah 2217	9113 1111
4 West clinics	St George Hospital 4 <sup>th</sup> floor, Ward Block	9113 4534
Renal Department	Montgomery Street Kogarah	9113 2622
4 West Haemodialysis	St George Hospital 4 <sup>th</sup> floor, Ward Block	9113 1151
The Sutherland Hospital Satellite Unit		9540 8660
St George Fresenius Medical Care		91688200
Peritoneal Dialysis Unit		9113 3775
Chronic Kidney Disease Clinical Nurse Consultant	St George Hospital 4 <sup>th</sup> floor, Ward Block	9113 3634
Renal Transplant Coordinator	St George Hospital 4 <sup>th</sup> floor, Ward Block	9113 4205
Kidney Supportive Care Clinical Nurse Consultant	St George Hospital 4 <sup>th</sup> floor, Ward Block	9113 2854
Renal Vascular Access Nurse	St George Hospital 4 <sup>th</sup> floor, Ward Block	9113 2808
Renal Dietitian	Nutrition and Dietetics 2 <sup>nd</sup> floor, Pritchard Wing	9113 2752
Renal Social Worker	Social Work Department 4 <sup>th</sup> Floor, Pritchard Wing	9113 2494

### SPECIAL NOTE FOR YOUR GENERAL PRACTITIONER

Kidney Health Australia provides accredited education for health professionals through the Kidney Check Australia (KCAT) program.

Please download a copy of the booklet:

Chronic Kidney Disease (CKD)

Management in General Practice 5<sup>th</sup> Edition 2024

From <https://kidney.org.au/health-professionals/ckd-management-handbook>

This booklet provides guidance and clinical tips to help identify, manage and refer CKD in your practice.

## CHAPTER 9 - GLOSSARY OF TERMS

<b>AV fistula</b>	A surgical connection between an artery and vein in the wrist. Required for haemodialysis treatments.
<b>Cortex</b>	Outer part of the kidney where most kidney function takes place
<b>Creatinine</b>	Breakdown product of muscle which becomes a waste product in the blood.
<b>Dialysis</b>	Filtering of the blood across a semi-permeable membrane i.e. haemodialysis, peritoneal dialysis.
<b>End stage renal failure</b>	Kidney failure where dialysis or transplantation is necessary to maintain life.
<b>Erythropoietin</b>	Hormone stimulated by the kidneys. Responsible for the production of red blood cells.
<b>Haemodialysis</b>	Filtering blood through an artificial membrane using a machine.
<b>Dry weight</b>	You are said to be at your dry weight when your blood pressure is within normal limits and you have no signs of fluid overload.
<b>immunosuppression</b>	Medications taken to prevent a recipient from rejecting a kidney transplant.
<b>Medulla</b>	The inner part of the kidney is responsible for concentrating the urine.
<b>Nephron</b>	Filtering component of the kidney.
<b>Peritoneal dialysis</b>	Dialysis utilising the peritoneum as the dialysis membrane.
<b>Renal</b>	Medical term meaning “to do with the kidneys”  E.g. renal failure.
<b>Urea</b>	Breakdown product of protein. Urea retention occurs in kidney failure
<b>Vascath</b>	A catheter inserted into the major neck or shoulder vessel which is used for haemodialysis. Used when there is no functioning AV fistula or vein graft.
<b>Vitamin D</b>	A hormone which is activated by the kidney. Necessary to absorb calcium

	into the system and prevent bone disease
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