

# Chronic Kidney Disease

Chronic kidney disease (CKD) means that your kidneys are damaged and as a result may not work properly. Many conditions can cause CKD. Severity can range from mild to end-stage kidney failure. Most cases are - mild or moderate, occur in older people, do not cause symptoms, and do not progress to end-stage kidney failure. However, it is important to detect even mild CKD as treatment may slow down the progression of the disease. Also, people with any stage of CKD have an increased risk of developing heart disease or a stroke. So, one of the main aims of treatment is to reduce this risk.

This article is quite long and detailed. There is a shorter summary version called *Chronic Kidney Disease - A Summary* which some people may prefer.

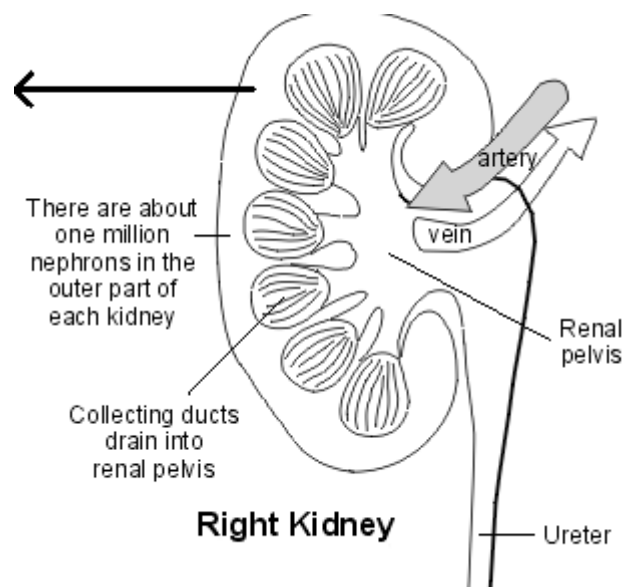
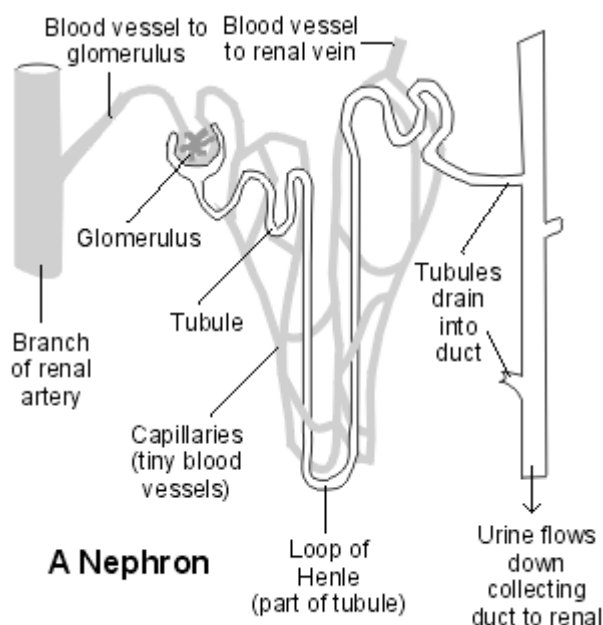
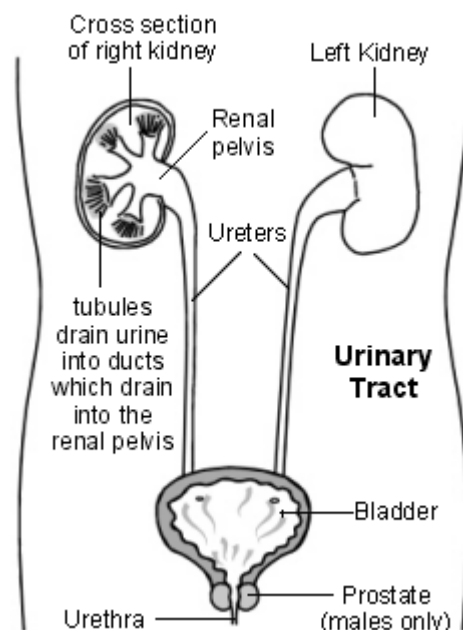
## Understanding the kidneys and urine

The two kidneys lie to the sides of the upper abdomen (the loins), behind the intestines, and either side of the spine. Each kidney is about the size of a large orange, but bean-shaped.

A large artery - the renal artery - takes blood to each kidney. The artery divides into many tiny blood vessels (capillaries) throughout the kidney. In the outer part of the kidneys tiny blood vessels cluster together to form structures called glomeruli.

Each glomerulus is like a filter. The structure of the glomerulus allows waste products and some water and salt to pass from the blood into a tiny channel called a tubule whilst keeping blood cells and protein in the bloodstream.

Each glomerulus and tubule make up a nephron. There are about one million nephrons in each kidney.



As the waste products and water pass along the tubule there is a complex adjustment of the content. For example, some water and salts may be absorbed back into the bloodstream, depending on the current level of water and salt in your blood. Tiny blood vessels next to each tubule enable this 'fine tuning' of the transfer of water and salts between the tubules and the blood.

The liquid that remains at the end of each tubule is called urine. This drains into larger channels (collecting ducts) which drain into the renal pelvis (the inner part of the kidney). The urine then passes down a tube called a ureter which goes from each kidney to the bladder. Urine is stored in the bladder until it is passed out when we go to the toilet.

The 'cleaned' (filtered) blood from each kidney collects into a large vein - the renal vein - which takes the blood back towards the heart.

## What are the main functions of the kidneys?

The main functions of the kidneys are to:

- Filter out waste products from the bloodstream to be passed out in the urine.
- Help control blood pressure - partly by the amount of water passed out of the body as urine and partly by making hormones which are involved in blood pressure control.
- Make a hormone called erythropoietin ('epo') which stimulates the bone marrow to make red blood cells. This is needed to prevent anaemia.
- Help keep various salts and chemicals in the blood at the right level. For example, sodium, potassium, calcium, and phosphate. An imbalance of salts and chemicals in the bloodstream can cause problems in other parts of the body.

## What is chronic kidney disease?

Chronic kidney disease (CKD) means that your kidneys are diseased or damaged in some way and as a result may not work properly. So, the various functions of the kidney, as described in the previous section, can be affected. A whole range of conditions can cause CKD (see later).

Some terms explained:

- **Chronic** means ongoing (persistent or long-term). It does not mean 'severe' as some people think. You can have a mild chronic disease. Many people have mild CKD.
- **Renal** means 'relating to the kidney'.
- **Chronic renal failure** is a term that is sometimes used but means much the same as chronic kidney disease. Chronic kidney disease (CKD) is a better term as 'failure' implies that the kidneys have totally 'packed in'. In most cases of CKD this is not so. In most people who have CKD there is only a mild or moderate reduction in kidney function which usually does not cause symptoms, and the kidneys have not 'failed'.
- **Acute renal failure** means that the function of the kidneys is rapidly affected - over hours or days. For example, the kidneys may go into 'acute renal failure' if you have a serious blood infection which can affect the kidneys. This is in contrast to CKD where the decline in function of the kidneys is very gradual - over months or years. Acute renal failure is not dealt with further in this article.

## How is CKD diagnosed?

A simple test can estimate the volume of blood that is filtered by the glomeruli in your kidneys over a given period of time. This test is called the estimated glomerular filtration rate (eGFR). A normal eGFR is 90 ml/min/1.73m or more. If some of the glomeruli (the tiny filters in the kidneys) are damaged and do not filter as much as normal, then the kidney is said to have reduced or impaired kidney function.

The eGFR test involves a blood test which measures a chemical called creatinine. Creatinine is a breakdown product of muscle. Creatinine is normally cleared from the blood by the kidneys. If your kidneys are not working properly and the glomeruli are not filtering as much blood as normal, the level of creatinine in the blood goes up. The eGFR is calculated from your age, sex and blood creatinine level. An adjustment to the calculation is needed for people with African-Caribbean origin.

CKD is diagnosed by the eGFR and other factors, and is divided into five stages:

Stage of Chronic Kidney Disease	eGFR ml/min/1.73m
Stage 1 - The eGFR shows normal kidney <i>function</i> but you are already known to have some kidney damage or disease. For example, you may have some protein or blood in your urine, an abnormality of your kidney, kidney inflammation, etc.	90 or more
Stage 2 - Mildly reduced kidney function AND you are already known to have some kidney damage or disease. People with an eGFR of 60-89 without any kidney damage or disease are not considered to have CKD.	60 to 89
Stage 3 - Moderately reduced kidney function.	30 to 59
Stage 4 - Severely reduced kidney function.	15 to 29
Stage 5 - Very severely reduced kidney function. This is sometimes called end-stage kidney failure or established renal failure.	Less than 15

### Who has the eGFR test?

This test is commonly done as a routine part of monitoring people with kidney diseases or with conditions that can affect the kidneys such as diabetes or high blood pressure. It is also often done as a routine test in many medical situations. If you are found to have CKD then the eGFR test is usually done at regular intervals to monitor your kidney function.

### How common is CKD?

About 1 in 10 people have some degree of CKD. It can develop at any age and various conditions can lead to CKD. It becomes more common with increasing age. About half of people aged 75 or more have some degree of CKD.

Most cases of CKD are mild or moderate.

### What causes CKD?

A number of conditions can cause permanent damage to the kidneys and/or affect the function of the kidneys and lead to CKD. Three common causes in the UK which probably account for about 3 in 4 cases of CKD in adults are:

- **Diabetes.** Diabetic kidney disease is a common complication of diabetes.
- **High blood pressure.** Untreated or poorly treated high blood pressure is a major cause of CKD. But also, CKD can cause high blood pressure as the kidney has a role in blood pressure regulation.
- **Ageing kidneys.** There appears to be an age-related decline in kidney function. About half of people aged 75 or more have some degree of CKD. In most of these cases the CKD does not progress beyond the moderate stage unless other problems of the kidney develop such as diabetic kidney disease.

Other conditions that can cause CKD include: diseases of the glomeruli such as glomerulonephritis (inflammation of the glomeruli in the kidneys); renal artery stenosis (narrowing); haemolytic-uremic syndrome; polycystic kidney disease; blockages to the flow of urine; drug and toxin-induced kidney damage; repeated kidney infections - but this list is not complete and there are many other uncommon causes.

## What are the symptoms of CKD?

You are unlikely to feel unwell or have symptoms with mild to moderate CKD - that is stages 1 to 3. (However, there may be symptoms of an underlying condition such as kidney pain with certain kidney conditions.) CKD is usually diagnosed by the eGFR test before any symptoms develop.

Symptoms tend to develop when CKD becomes severe (stage 4) or worse. The symptoms at first tend to be vague and non-specific such as feeling tired, having less energy than usual, and just not feeling well. With more severe CKD symptoms that may develop include:

- difficulty thinking clearly
- a poor appetite
- weight loss
- dry, itchy skin
- muscle cramps
- fluid retention which causes swollen feet and ankles
- puffiness around the eyes
- need to pass urine more often than usual
- being pale due to anaemia
- feeling sick

As the kidney function declines to stages 4 or 5 then various other problems may develop. For example, anaemia and an imbalance of calcium, phosphate and other chemicals in the bloodstream. These can cause various symptoms such as tiredness due to anaemia, and bone thinning or fractures due to calcium and phosphate imbalance. End-stage renal failure (stage 5) is eventually fatal unless treated.

## Do I need any further tests?

As mentioned, the eGFR test is done to diagnose and monitor the progression and severity of CKD. For example, it should be done routinely at least once a year in people with stage 1 and 2 CKD, and more frequently if you have stage 3, 4 or 5 CKD.

You are likely to have routine urine 'dipstick' tests from time to time to check for blood and protein in the urine. Also, blood tests may be done from time to time to check on your blood level of chemicals such as sodium, potassium, calcium and phosphate.

The need for other tests then depends on various factors and your doctor will advise. For example:

- An ultrasound scan of the kidneys or a kidney biopsy may be advised if certain kidney conditions are suspected. For example, if you have a lot of protein or blood in your urine, if you have pain over your kidneys, if kidney inflammation is suspected, etc.
- A scan or a biopsy is not needed in most cases. This is because most people with CKD have a known cause for the impaired kidney function such as a complication of diabetes, high blood pressure, or ageing.
- If the CKD progresses to stage 3 or worse then various other tests may be done. For example, blood tests to check for anaemia and an altered level of parathyroid hormone (PTH). PTH is involved in the control of the blood level of calcium and phosphate.

## What is the treatment for CKD?

Treatment for most cases of CKD is done by GPs. This is because most cases are mild to moderate (stage 1-3) and do not require any specialist treatment. Your GP may refer you to a specialist if you develop stage 4 or 5 CKD, or at any stage if you have problems or symptoms that require specialist investigation.

The aims of treatment include:

- If possible, treat any underlying kidney condition.
- Prevent or slow down the progression of CKD.
- Reduce the risk of developing cardiovascular disease.
- Relieve symptoms and problems caused by CKD.

### Treating any underlying kidney condition

There are various conditions that can cause CKD. For some of these there may be specific treatments for that particular condition. For example, good glucose control for people with diabetes, blood pressure control for people with high blood pressure, antibiotics for people with recurring kidney infections, surgery for people with a blockage to urine flow, etc.

### Preventing or slowing down the progression of CKD

Once CKD has developed, in many cases it tends to gradually become worse over months or years. This can occur even if an underlying cause has been treated. You should have checks every now and then by your GP or practice nurse to monitor your kidney function (eGFR). They will also give you treatment and advice on how to prevent or slow down the progression of CKD. This usually includes:

- **Blood pressure control.** The most important treatment to prevent or delay the progression of CKD, whatever the underlying cause, is to keep your blood pressure well controlled. Most people with CKD will require medication to control their blood pressure. Your doctor will give you a 'target' blood pressure level to aim for. This is usually below 130/80 mm Hg, and lower in some circumstances.
- **Review of your medication.** Certain medicines can affect the kidneys as a side-effect which can make CKD worse. For example, if you have CKD you should not take anti-inflammatory medicines unless advised to by a doctor. You may also need to adjust the dose of certain medicines that you may take if your CKD gets worse.

### Reducing the risk of developing cardiovascular disease

People with CKD have an increased risk of developing cardiovascular diseases such as heart disease, stroke, and peripheral vascular disease. More people with CKD die of cardiovascular related problems than of end-stage renal failure. This is why reducing any other cardiovascular 'risk factors' is so important. See leaflet called '*Preventing Cardiovascular Diseases*' for details, but briefly this typically includes:

- Good control of blood pressure (and blood glucose level if you have diabetes).
- Medication to lower the cholesterol level - needed in many cases.
- A daily low dose of aspirin - depending on your age and other factors. This reduces the risk of blood clots forming which helps to prevent heart attacks and strokes.
- Where relevant, to tackle lifestyle risk factors. This means to:
  - Stop smoking if you smoke.
  - Eat a healthy diet which includes a low salt intake.
  - Keep your weight and waist in check.
  - Take regular physical activity.
  - Cut back if you drink a lot of alcohol.

### Relieving symptoms and problems caused by CKD

If CKD becomes severe you may need treatment to combat various problems caused by the

poor kidney function. For example:

- Anaemia may develop which may need treatment with iron or erythropoietin (a hormone normally made by the kidneys).
- Imbalances of calcium or phosphate in the blood may need treatment.
- You may be advised about how much fluid to drink, and how much salt to take.
- Other dietary advice may be given which can help control factors such as the level of calcium and potassium in your body.

If end-stage kidney failure develops, you are likely to need kidney dialysis or a kidney transplant to survive.

People with stage 3 CKD or worse should be immunised against influenza each year, and have a one-off immunisation against pneumococcus. People with stage 4 CKD should be immunised against hepatitis B.

## What is the outlook (prognosis)?

Stage 1-3 CKD (mild to moderate) is common with most cases occurring in older people. It tends to get worse over months or years. However, the rate of progression varies from case to case, and often depends on the severity of any underlying condition. For example, some primary kidney conditions may cause your kidney function to get worse relatively quickly. However, in many cases CKD progresses only very slowly.

Only about 1 in 10 people with CKD progress to end-stage kidney failure (stage 5 CKD) that requires kidney dialysis or kidney transplant.

For many people with CKD there is a much higher risk of developing serious cardiovascular disease than of developing end-stage kidney failure. Attention to blood pressure control and to factors that reduce your risk of developing cardiovascular diseases can make a big difference to your outlook.

## Further help and information

### National Kidney Federation

6 Stanley Street, Worksop, Nottinghamshire, S81 7HX  
Helpline: 0845 601 0209 Web: [www.kidney.org.uk](http://www.kidney.org.uk)

## References

- [Chronic Kidney Disease in Adults](#): UK Guidelines for Identification, Management and Referral. Royal College of Physicians and Renal Association 2006
- [Clinical Practice Guidelines for the Care of Patients with Chronic Kidney Disease](#). Renal Association 2007
- [Mauro Verrelli](#) Chronic Renal Failure eMedicine June 2006
- [Renal Association](#) The short CKD eGuide, derived from the UK CKD Guidelines (2005)

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Comprehensive patient resources are available at [www.patient.co.uk](http://www.patient.co.uk)

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