

Diabetic Kidney Disease

Diabetic Nephropathy

Diabetic kidney disease is a complication that occurs in some people with diabetes. It can progress to kidney failure in some cases. Treatment aims to prevent or delay the progression of the disease. Also, to reduce the risk of developing cardiovascular diseases such as heart attack and stroke which are much more common than average in people with this disease. Treatments include: an ACE inhibitor drug; good control of blood sugar and blood pressure; lowering the cholesterol level; low dose aspirin in some cases, and tackling lifestyle risk factors such as smoking. Limiting protein intake may also be advised.

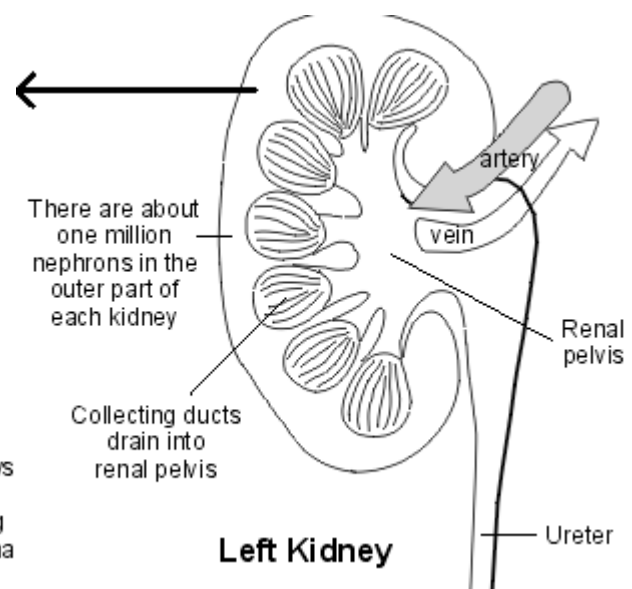
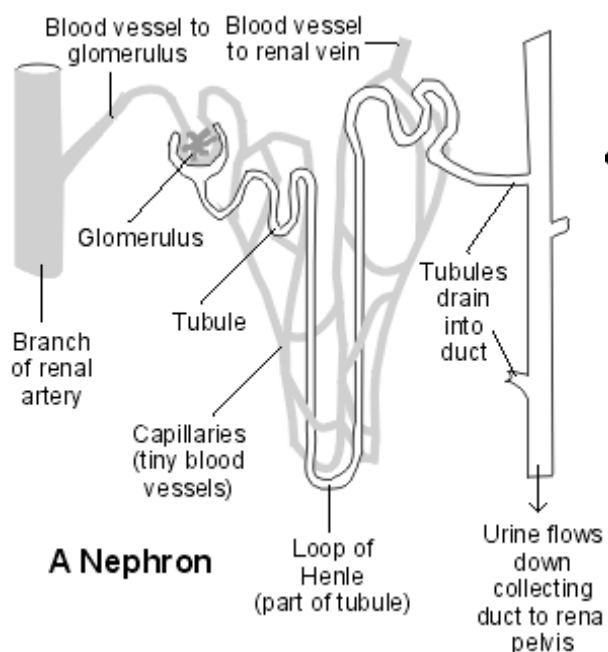
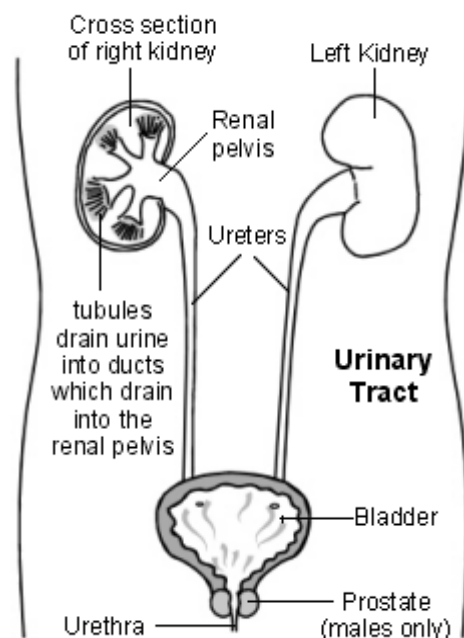
Understanding kidneys and urine

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 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 into a tiny channel called a tubule while keeping blood cells and protein in the bloodstream.

Each glomerulus and tubule is called 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 (ducts) which drain into the renal pelvis (the inner part of the kidney). From the renal pelvis the urine 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 through the urethra when we go to the toilet.

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

What is diabetic kidney disease?

Diabetic kidney disease (diabetic nephropathy) is a complication that occurs in some people with diabetes. In this condition the filters of the kidneys, the glomeruli, become damaged. Because of this the kidneys 'leak' abnormal amounts of protein from the blood into the urine. The main protein in the blood that leaks out from the damaged kidneys is called albumin. In normal healthy kidneys only a tiny amount of albumin is found in the urine. A raised level of albumin in the urine is the typical first sign that the kidneys have become damaged by diabetes.

Diabetic kidney disease is divided into two main categories, depending on how much albumin is lost through the kidneys:

- **Microalbuminuria.** This is when the amount of albumin that leaks into the urine is between 30 and 300 mg per day. Microalbuminuria is sometimes called incipient nephropathy.
- **Proteinuria** This is when the amount of albumin that leaks into the urine is more than 300 mg per day. Proteinuria is sometimes called macroalbuminuria or overt nephropathy.

How does diabetic kidney disease develop and progress?

A raised blood glucose (sugar) level that occurs in people with diabetes can cause a rise in the level of some chemicals within the kidney. These chemicals tend to make the glomeruli more 'leaky' which then allows albumin to leak into the urine. In addition, the raised blood glucose level may cause some proteins in the glomeruli to link together. These 'cross-linked' proteins can trigger a localized scarring process. This scarring process in the glomeruli is called glomerulosclerosis. It usually takes several years for glomerulosclerosis to develop and it only happens in some people with diabetes.

As the condition becomes worse, scarred tissue (glomerulosclerosis) gradually replaces healthy kidney tissue. As a result, the kidneys become less and less able to do their job of filtering the blood. This gradual 'failing' of the kidneys may gradually progress to what is known as end-stage kidney failure.

- Microalbuminuria is the usually the first sign that diabetic kidney disease has developed. Over months or years, microalbuminuria may go away (especially if treated - see below), persist at about the same level, or progress to proteinuria.
- Proteinuria is irreversible. If you develop proteinuria it usually marks the beginning of a gradual decline in kidney function towards end-stage kidney failure sometime in the future.

How common is diabetic kidney disease?

For people with Type 1 diabetes

Microalbuminuria or proteinuria is rarely present at the time when the diabetes is first diagnosed. By five years after the diagnosis of diabetes, about 14 in 100 people will have developed microalbuminuria. After 30 years about 40 in 100 people will have developed microalbuminuria. Some people with microalbuminuria progress to proteinuria and kidney failure.

For people with Type 2 diabetes

At the time the diabetes is first diagnosed, about 12 in 100 people have microalbuminuria and 2 in 100 have proteinuria. This is not because diabetic kidney disease happens straight away in some cases but because many people with Type 2 diabetes do not have their diabetes diagnosed for quite some time after the disease had begun. Of those people who do not have any kidney problem when their diabetes is diagnosed, microalbuminuria develops in about 15 in 100 people, and proteinuria in 5 in 100 people, within five years.

Diabetic kidney disease is much more common in Asian and black people with diabetes than in white people.

How is diabetic kidney disease diagnosed and assessed?

Diabetic kidney disease is diagnosed when the level of albumin in the urine is raised and there is no other obvious cause for this. Urine tests are part of the routine checks that are offered to people with diabetes from time to time. Urine tests can detect albumin, and measure how much is present in the urine.

A blood test can show how well the kidneys are working. The blood test measures a chemical called creatinine which is a breakdown product of muscle. This is normally cleared from the blood by the kidneys. If your kidneys are not working properly, the level of creatinine in the blood goes up. An estimate of how well your kidneys are working can be made by taking into account the blood level of creatinine, your age and sex. This estimate of kidney function is called the estimated glomerular filtration rate (eGFR).

What increases the risk of developing diabetic kidney disease?

All people with diabetes have a risk of developing diabetic kidney disease. However, a large research trial showed that there are certain factors that increase the risk of developing this condition. These are:

- In people with Type 1 diabetes, the risk is increased:
 - The poorer the control of blood sugar levels. (The greater the HbA1c, level the greater the risk.)
 - The length of time you have had diabetes.
 - The more overweight you become.
 - If you are male.
- In people with Type 2 diabetes the risk is increased:
 - The poorer the control of blood sugar levels. (The greater the HbA1c, level the greater the risk.)
 - The length of time you have had diabetes.
 - The more overweight you become.
 - Having high blood pressure. The higher the pressure, the greater the risk.
 - If you are male.

So, good control of your blood glucose level, keeping your weight in check and treating high blood pressure (especially if you have Type 2 diabetes) will reduce your risk of developing diabetic kidney disease.

If you have early diabetic kidney disease (microalbuminuria), the risk that the disease will become worse is increased with:

- The poorer the control of blood sugar levels. (The greater the HbA1c, level the greater the risk.)
- Having high blood pressure. The higher the pressure, the greater the risk.
- Smoking.
- A high protein diet in people with Type 1 diabetes.

What are the possible complications?

End-stage kidney failure

In people with proteinuria, end-stage kidney failure develops in approximately 8 in 100 people after 10 years. If this occurs then you would need kidney dialysis or a kidney transplant.

Cardiovascular diseases

All people with diabetes have an increased risk of developing cardiovascular diseases such as heart disease, stroke and peripheral vascular disease. If you have diabetes and diabetic kidney disease, then your risk of developing cardiovascular diseases is increased further. The worse the kidney disease, the further increased the risk. This is why reducing any other cardiovascular risk factors is so important if you have diabetic kidney disease (see below).

High blood pressure

Kidney disease has a tendency to increase blood pressure. And, increased blood pressure has a tendency to make kidney disease worse. Treatment of high blood pressure is one of the main treatments of diabetic kidney disease.

What is the treatment for diabetic kidney disease?

Treatments that may be advised are discussed below. Treatments aim to:

- prevent or delay the disease progressing to kidney failure. In particular, if you have microalbuminuria it does not always progress to the proteinuria phase of the disease.
- reduce the risk of developing cardiovascular diseases such as heart disease and stroke

An angiotensin converting (ACE) inhibitor

There are several types and brands. These drugs work by reducing the amount of a chemical that you make in your bloodstream called angiotensin II. This chemical tends to constrict (narrow) blood vessels. Therefore, less of this chemical causes the blood vessels to relax and widen, and so the pressure of blood within the blood vessels is reduced. ACE inhibitors are drugs that are often used to treat high blood pressure. However, the way they work also seems to have a protective effect on the kidneys and heart. Therefore they help to prevent or delay the progression of the kidney disease.

An angiotensin-II receptor antagonist (AIIIRA)

There are several types and brands. They work in a similar way to ACE inhibitors. One may be used instead of an ACE inhibitor if you have problems or side-effects with taking an ACE inhibitor. (For example, some people taking an ACE inhibitor develop a persistent cough.)

Good control of your blood glucose level

This will help to delay the progression of the kidney disease and to reduce your risk of developing associated cardiovascular diseases such as heart disease and stroke. Ideally, the aim is to maintain your HBA1c to less than 6.5%. See leaflets called *Type 1 Diabetes* and *Type 2 Diabetes* for details.

Good control of your blood pressure

Strict blood pressure control is likely to reduce the risk of developing cardiovascular diseases and prevent or delay the progression of kidney disease. Most people should already be taking an ACE inhibitor or angiotensin-II receptor antagonist (described above). These drugs lower blood pressure. However, if the blood pressure remains at 130/80 mmHg or more then one or more additional drugs may be advised to get the blood pressure to below this target level.

Limiting your dietary protein may be advised

Restricting the amount of protein in the diet has been shown to have a small effect at reducing the progression of the kidney disease in people with Type 1 diabetes. However, this is not routine treatment in primary care. The effect in people with Type 2 diabetes is debatable.

Other treatments to reduce risk factors

Other treatments that reduce the risk of developing associated cardiovascular diseases include:

- **Drug treatment to lower your cholesterol level**, whatever the initial level. The aim is:
 - To reduce total cholesterol to less than 4.0 mmol/l *and* LDL cholesterol to less than 2.0 mmol/l, OR
 - A 25% reduction in total cholesterol *and* a 30% reduction in LDL cholesterol.
 - Whichever of the above gives the greatest reduction.
- **A daily low dose of aspirin** - depending on your age and other factors. This reduces the risk of blood clots forming. This helps to prevent heart attacks and strokes. See leaflet called '*Aspirin to Prevent Blood Clots*'.
- **Where relevant, to tackle lifestyle risk factors.**
This means to:
 - Stop smoking if you smoke.
 - Eat a healthy diet.
 - Keep your weight and waist in check.
 - Take regular physical activity.
 - Cut back if you drink a lot of alcohol.

What is the outlook (prognosis)?

If you have microalbuminuria, this may clear away, especially with treatment. For example, one study followed up 386 people with microalbuminuria for six years. After the six years:

- In about 6 in 10 cases the albumin in the urine had gone away.
- In about 1 in 10 cases the microalbuminuria had stayed unchanged.
- In about 2 in 10 cases the disease had progressed to proteinuria.

If you have proteinuria, over time the disease tends to get worse and progress to end-stage kidney failure. However, the length of time this takes can vary and it may take years. If your kidneys do begin to fail you should be referred to a kidney specialist. Once the kidney function goes below a certain level then you will need kidney dialysis or a kidney transplant.

A main concern is the increased risk of developing cardiovascular diseases. Cardiovascular diseases such as heart attack and stroke are the main causes of death in people with diabetic kidney disease. The treatments outlined above will reduce the risk of these occurring.

Further help and information

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 Tel (office): 020 7424 1000
 Web: www.diabetes.org.uk

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