

What I tell my patients about diabetes and their kidneys

This article will be of interest to people whose diabetes may be affecting their kidneys. It does not intend to answer all of your questions, but rather to suggest questions that you can ask your doctor, dietitian or nurse.

If you have diabetes it does not necessarily mean that any kidney problems you develop will have been caused by the diabetes. Someone with diabetes is just as likely as anyone else to have some sort of kidney problems. You should ask your doctor to explain what the likely cause of your kidney problem is.

The severity of kidney problems can be spread over a wide spectrum. Broadly speaking, they range from very minor – when you may feel well and have very few symptoms – to when you feel very unwell and may need kidney replacement treatment, such as dialysis or transplantation.

There are many stages in between these two extremes, however, and these are described in more detail below.

Microalbuminuria

The earliest sign of kidney problems is indicated by the presence of a type of protein, called albumin, which becomes detectable in a very small quantity in the urine – a condition known as microalbuminuria. It is detected by carrying out tests on your urine. One such test involves collecting a patient's urine for 24 hours and measuring how much albumin is present.

Collecting urine over 24 hours is inconvenient for patients, and other approaches have been developed. One involves measuring the ratio of the amount of albumin to the amount of creatinine in a small sample of urine collected at any time. Creatinine is a substance that is normally filtered from the blood into the urine by the kidneys.

Measurements of the level of creatinine in the blood and urine can be a useful indicator of kidney function. An abnormal albumin: creatinine ratio is one in which the ratio of albumin to creatinine is greater than 3.5 in men and 2.5 in women.

Your doctor will also have arranged for your urine to be checked for any infection. This is because an infection can increase the level of albumin or protein in the urine. Detecting microalbuminuria is important. If it has developed, alterations to your treatment (see later) can slow progression to the next stage of diabetic kidney disease. This is characterised by an increase in the total amount of protein in your urine and a decline in your kidney function.

Proteinuria

In addition to checking for microalbuminuria your clinic nurse will also check your urine for protein using a special colour-coded dipstick. This indicates the total amount of protein in the urine (not just albumin).

If this indicates an excess of protein, the amount can be measured more precisely in a 24-hour collection.

Dr AC Felix Burden MD FRCP
Consultant
Physician and
Honorary Senior
Lecturer
University
Hospitals of
Leicester

The severity of kidney problems can be spread over a wide spectrum



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When your kidneys are not functioning properly, you should try to ensure that you have a healthy blood pressure



Blood creatinine levels

As part of your usual diabetes care, your doctor will also measure the level of creatinine in your blood. This is measured in units called micromoles per litre ($\mu\text{mol/l}$). If your kidneys are not working well, then the amount of creatinine in your blood increases.

The normal level of creatinine in your blood should be less than $120 \mu\text{mol/l}$. Your doctor will measure it at least once a year. If the level rises above $120 \mu\text{mol/l}$, then it will have to be more frequently measured. The level of creatinine will help guide your doctor to investigate and treat any kidney problems.

Raised creatinine level in your blood but less than $150 \mu\text{mol/l}$ and you feel well ...

If there is anything unusual about the change in your blood's creatinine levels, or if you do not have other complications arising from diabetes, such as eye disease, your doctor will ask a kidney specialist to see you to make sure there is no other cause needing treatment.

If your blood's creatinine level is above $150 \mu\text{mol/l}$ and/or you feel unwell ...

The loss of kidney function at this stage means that it will not be too long before you need extra treatment. This will involve checking the amount of haemoglobin in your blood to see if you are anaemic. Anaemia (a deficiency in haemoglobin which is carried in red blood cells), can be treated with an injection called erythropoietin (EPO).

Your calcium levels and calcium stores may be affected. The kidneys play an important role in keeping bones healthy by converting vitamin D to its most active form. You may need additional supplements of this active form of vitamin D known as alfacalcidol.

The acid balance may be disturbed and you may need treatment for this.

Which treatments can prevent or slow the progression of kidney disease?

The most important measures for preventing or slowing the progression of diabetic kidney disease are controlling the diabetes, and lowering the blood pressure. A group of drugs called ACE inhibitors (ACE stands for angiotensin-converting enzyme) are particularly effective at protecting the kidneys once microalbuminuria has developed. ACE inhibitors are commonly used to lower blood pressure, but seem to protect the the kidneys even when blood pressure appears normal.

Controlling your body's glucose level

Your body's ability to control the level of glucose in its blood is measured using a test called haemoglobin A1c (HbA1c), often known as a

Box 1: ACE inhibitors

Trade name	Generic name
Accupro®	Quinapril
Acepril®	Captopril
Capoten®	Captopril
Carace®	Lisinopril
Innovace®	Enalapril
Odrik®	Trandolapril
Perdix®	Moexipril
Staril®	Fosinopril
Tanatril®	Imidapril
Tritace®	Ramipril
Vascase®	Cilazapril
Zestril®	Lisinopril

long-term test. The result of the test is given as a percentage, which indicates your average blood glucose levels over a three-month period. All complications associated with diabetes, including kidney problems, will worsen unless the figure measured with an HbA1c test is kept as low as possible.

Your doctor will have discussed how best to treat your diabetes through careful attention to your diet, alone or in combination with tablets or insulin. When the level of creatinine in your plasma (plasma is the colourless fluid part of the blood) is normal, you can be treated with any of the tablets used to treat diabetes, called oral hypoglycaemic agents (OHAs), which suit you. If OHAs do not keep your HbA1c below 7%, you may need to take insulin. To achieve this ideally your pre-food capillary blood glucose should be between 3.8 and 5.5 mmol/l, and one to two hours following food, between 3.8 and 7mmol/l.

The OHAs lower the amount of glucose in your blood. If you have kidney problems the dose may need reducing to prevent the amount of glucose in your blood from becoming too low, and preventing the need to treat yourself for hypoglycaemia (low blood sugar). If this occurs, you may need to reduce your treatment, and ask your doctor whether you should change the type of treatment you are receiving.

If your kidney disease worsens and your blood's creatinine level rises above $140 \mu\text{mol/l}$ (normal is less than $120 \mu\text{mol/l}$) then you should stop using certain OHAs. These include metformin and rosiglitazone. If this happens, there are other OHAs which you can still use, but these must be taken at a reduced dose.

If your creatinine level continues to rise, then the chemicals in most OHA tablets can also build up in your body. This build-up will increase the chances of hypoglycaemia developing. You should ask your doctor whether you should use insulin injections at this time. At this stage, insulin injections can often be a safer treatment.

ACE inhibition

If you have early diabetic kidney disease, ACE inhibitors (see Box 1) reduce the chances of the condition worsening – they reduce the risk by about 25%. However, as with all drugs, they cause side-effects in a small number of patients. The most common side-effect is a dry cough. About one in ten people taking ACE inhibitors develop this cough, which disappears once they have stopped taking the tablets. If you think you may have this side-effect, discuss it with your doctor. The best dose is the one which you can easily tolerate – where possible, it should be the maximum dose.

How important is controlling your blood pressure?

When you have kidney involvement, you need to keep your blood pressure as low as possible. Blood pressure is a measurement of the pressure that blood exerts against the walls of the main arteries and is quoted in millimetres of mercury (mmHg). Measurements are made when the heart is contracting (the systolic pressure) and during relaxation (the diastolic pressure); results are presented as the systolic over the diastolic pressure. For each 10 mmHg increase in the systolic pressure, the risk of damage to your kidneys increases by at least 20%.

Many patients want to know what their blood pressure measurement should be. It is probably about 110 mmHg of systolic pressure and 70 mmHg diastolic pressure (this would be written like this: 110/70 mmHg). To achieve blood pressures this low, you may need to take several different drugs.

Many people worry about this. All the evidence suggests that a low blood pressure is important in preventing kidney problems. However, if you feel that a particular tablet is not helping you, speak to your doctor or nurse before you consider temporarily stopping it to see if you feel better.

When should your blood pressure be measured, and how?

Your blood pressure is usually monitored by a healthcare professional. However, if you have been instructed to measure your blood pressure yourself, then an ideal systolic reading should be at least 7 mmHg less than has been suggested above.

You should ask your doctor or nurse to check your machine to make sure that the measurements are accurate, within 5 mmHg of their own machine. Blood pressure can also be measured at home over a 24-hour period. The results from a 24-hour measurement also need to be 7 mmHg lower than those given above.

A 24-hour measurement will give information about your blood pressure during the night, which other methods are unable to provide. These overnight results are important because the body's loss of control over its blood pressure at night-time seems to cause particular harm to the kidney.

What tablets are best suited to controlling blood pressure?

There are many different types of drugs used to control blood pressure. The drugs mentioned earlier – ACE inhibitors – are usually given first, although they are often not enough to reduce blood pressure sufficiently. If this is the case, then you may be given different tablets. These include beta-blockers, calcium channel blockers, diuretics and alpha-blockers.

What if the doctor or nurse tells you your blood pressure is normal?

Ask them for the actual value and get to know what this means. If it is higher than is ideal, ask them if you should be receiving extra tablets. Always keep your salt intake low and make sure that you eat five portions of fruit or vegetables each day. This will help to reduce your blood pressure.

What can you do to reduce the risk of heart disease?

One of the commonest causes of death in Britain is heart disease. Other areas of the body which,



Diabetes and kidney problems increase the risk of heart disease; these risks are further increased by smoking



like the heart, have major arteries that carry blood around the body can also become diseased, leading to stroke and poor circulation to the legs. Poor circulation to the legs can, in extreme cases, lead to gangrene and amputation. People with diabetes have a higher risk of developing these problems. This risk is even higher if you have any form of kidney disease. However, there is plenty that you can do to minimise these risks. The following advice applies to anyone with any of the stages of kidney disease described above.

Do not smoke

If you are a smoker then you must stop smoking. Find out if you can be referred to a service which provides a programme designed to help you stop smoking. You may be able to receive counselling, support, nicotine replacement therapy and, possibly, the anti-smoking drug Zyban™. These will help you stop smoking but you have got to make a considerable effort as well!

Take aspirin – if you can

Aspirin can reduce the risk of developing cardiovascular disease by about 20%. Provided that you are not allergic to aspirin, or have an active ulcer or uncontrolled high blood pressure (greater than 160/90 mmHg), then your doctor may advise you to take one aspirin each day – which is usually 75 mg. If you are allergic to aspirin, then there are alternative tablets. If you have an active ulcer you can have this treated.

Reduce the amount of fat you eat

All fats seem to add to the risk of having heart attacks – but some types are worse than others. Olive oil and spreads like Benecol™ are the least harmful sources of fat in everyday food.

Be aware of your cholesterol level

Your total cholesterol should be less than 5 mmol/l, and the harmful low density lipoprotein (LDL) cholesterol less than 3 mmol/l.

For further advice about diabetes and membership details for Diabetes UK contact:

Diabetes UK
10 Queen Anne Street
London W1M 0BD.
Tel: 020 7323 1531.
website: www.diabetes.org.uk

The National Kidney Research Fund
Kings Chambers
Priestgate
Peterborough PE1 1FG
Tel: 01733 704678.
website: nkrf.org.uk



If it is more than three, and you have already changed your diet, ask your doctor for tablets which will lower your level of cholesterol. These are called statins. The dose at which these should be taken often needs to be at the maximum but they dramatically lower the LDL cholesterol.

The presence in the body of the helpful cholesterol called high density lipoprotein (HDL) is increased by exercise. Exercise is important for all people, but particularly for people with diabetes suffering from kidney problems.

Exercise will:

- Help insulin to work
- Increase levels of HDL cholesterol
- Preserve muscles.

Specific problems

Glucose meters

Some machines used to measure blood glucose from fingerprick samples are affected by the fluids used in dialysis, and some are less accurate if you are anaemic. Check with your meter manufacturer's telephone helpline to see if this is the case.

HbA1c tests

Some methods used to measure HbA1c in the laboratory produce readings which appear artificially high in patients with kidney disease.

What you can do to help yourself

There have been dramatic changes in the management of kidneys in people with diabetes over the last few years. Even so, it remains important that you are involved in the decisions about your care. You should also contact support organisations such as the National Kidney Research Fund and Diabetes UK ■

Key points

- If you have diabetes it does not necessarily mean that any kidney problems you develop will have been caused by the diabetes.
- By controlling the level of glucose in your blood, and your blood pressure, you can help to slow down the onset of any kidney problems.
- The risk of heart disease is higher if you have diabetes or kidney disease. However, there is plenty you can do to reduce this risk.
- You should stop smoking and take measures to reduce your blood cholesterol level.