

Produced by Dr. David Voss, Specialist Renal Physician
in the interest of public health education.

www.kidney.net.nz

Diabetes Mellitus Kidney Information Sheet

What is diabetes mellitus?

Diabetes mellitus (often referred to just as diabetes) is a lack of insulin to maintain blood sugar levels. As a result of the lack of insulin, glucose is not handled properly in the human body, and high blood sugar (glucose) levels result. The high blood sugar and / or some of its products are thought to cause most of the damage to the body.

Two main types of diabetes are type 1 diabetes mellitus (insulin dependent) where there is a lack of insulin released by the pancreas. The second major type is type 2 diabetes mellitus (non-insulin dependent). Type 2 has several subtypes which may include the need for insulin to be used. The primary issue in type 2 diabetes mellitus is a lack of insulin effect at the target organ. Even though insulin levels may be normal there is a resistance to insulin at the target cell level.

The small blood vessels, of the eyes, heart, kidneys and nerves are particularly vulnerable. Over many years the blood vessels walls become damaged, and bleed, or become narrowed and may clog up, leading to a loss of blood supply to the area that blood vessel supplies.

How is diabetes treated?

Diet changes, weight reduction in overweight people, and increased physical activity are all important life-style changes to improve the control of diabetes mellitus. Some people do not require tablets or insulin for their diabetes if they change their life-style, particularly in the early stages of type 2 diabetes mellitus.

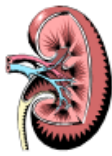
Some people with diabetes mellitus can, in the early stages, manage their diabetes with these life-style changes, but most require medications – either tablets or insulin. Insulin is always given by injection.

Regular testing of blood sugar levels at home and visits to the doctor and nurse for on-going monitoring are also essential.

Some new terminology definitions

- Type 1 diabetes mellitus (formally called insulin dependent or juvenile onset diabetes mellitus)

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- Type 2 diabetes mellitus (formally called non-insulin dependent or adult onset diabetes mellitus)
 - There are subtypes of type 2 diabetes mellitus e.g. maturity onset diabetes of the young (MODY) and gestational diabetes mellitus
- Moderately Increased Albuminuria (previously called Microalbuminuria)
 - Defined as 30 – 300mg per day of urinary protein
 - Or 30 – 300mg per gram of creatinine on a random urine sample
- Severely Increased Albuminuria (previously called macroalbuminuria)
 - Previously referred to as 300mg per 24 hours of albumin excretion
 - Or 300mg per gram of creatinine on a random urine sample (ACR)

How does diabetes mellitus affect the kidneys?

The kidney acts as a filter of the blood, removing the wastes from the blood. Over years of high blood sugar levels, damage occurs to the fine blood vessel walls in the kidney filters. The filters become leaky. The earliest sign of diabetic damage to kidneys is protein in the urine.

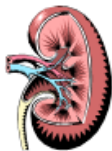
A urine and blood test is performed to check for damage to the kidneys. The presence of microalbuminuria (moderately elevated albumin), or an albumin creatinine ratio greater than 2.5mg/mmol – 3.5mg/mmol (depending upon local laboratory limits reference range) in a diabetic is suggestive of diabetic kidney damage (diabetic nephropathy).

Further damage to the fine filters in the kidney can lead to blood leaking into the urine. Usually only a small amount of blood leaks, too small amount to see with the eye and requires laboratory testing – looking at a urine sample under a microscope.

In type 1 diabetes mellitus after about 15 years since the diagnosis of diabetes mellitus, between 20% and 30% of patients will have developed a moderately increased albuminuria (microalbuminuria). Less than half of these people will progress to severely increased albuminuria and impaired renal functions. Aggressive management with ACEi and ARBs early on has been successful in delaying the progression of diabetic nephropathy.

It is felt that in Caucasians type 2 diabetes mellitus is less likely and slower at progressing towards kidney damage. Moderate albuminuria is the first indication of kidney involvement of diabetes mellitus. Not everybody with albuminuria who is a diabetic means that it is of diabetic cause and only a specialist renal physician will be able to investigate this further if indicated. In type 2 diabetes mellitus about 25% of patients 10 years after diagnosis will have moderately elevated albuminuria, and maybe as many as 5% will have severely

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elevated albuminuria. Over the years between 2% – 3% per annum will progress from moderately elevated albuminuria ensuring severely elevated albuminuria and onward to chronic kidney disease.

Approximately 30% of people with diabetes mellitus and established kidney disease do not have protein in their urine but still have diabetic nephropathy with chronic kidney disease. Many of these people end up seeing a kidney specialist (renal physician) to have the diagnosis confirmed by a [kidney biopsy](#). Often it's blood vessel damage, and hence the importance to have a healthy lifestyle to minimise damage and future damage to your blood vessels. Healthy eating, regular exercise, not smoking and good control of your cholesterol levels are all parts of protecting your blood vessels.

Although these rates of progression are slow, they can be slowed even more with early diagnosis, regular review (recommendation is 3 monthly) and aggressive management with blood pressure control (goal below 125/75) and minimisation of albuminuria with ACE or ARB medication.

Prolonged on-going damage to the kidneys leads to deposits of material in the kidney, and over several years the filters scar up, and no longer function. The kidneys cannot grow more or new filters. As more and more filters scar up, the kidney fails to adequately clean the blood of the waste products. The build-up of these waste products leads to the symptoms of kidney disease.

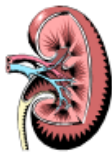
Not everyone with diabetes mellitus and protein in the urine will progress to more serious kidney damage. We do not know what causes some people with diabetes mellitus to progress to more serious kidney damage. Maori and Pacific Islander populations are four to five times more likely to get serious kidney damage from diabetes mellitus.

How do I know diabetes mellitus is affecting my kidneys?

There are no early warning symptoms. Symptoms usually do not develop until kidney damage is advanced, and often as much as 80% or more of kidney function is lost irreversibly. It is therefore important for the regular follow up and monitoring with your health care professional (usually your general practitioner).

It is important to be suspicious of the kidneys being involved in people with diabetes mellitus. Blood tests for control of diabetes mellitus (HbA1c), and regular urine tests looking for albumin in the urine, and kidney function blood tests (urea and creatinine), and regular blood pressure checks are paramount.

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What can be done to prevent diabetes mellitus damaging the kidneys?

Evidence now shows that the good control of diabetes mellitus, and good control of blood pressure (below 125/75), and the use of a special blood pressure lowering medications ([ACE inhibitors and ARBs](#)) all are important in preventing, and delaying further damage, to the kidneys from diabetic nephropathy.

Avoiding of [kidney toxins](#) and [medications](#) that may damage the kidneys is important.

Monitoring of blood sugar levels at home is important. Regular assessment of sugar control with a blood test for glycosylated haemoglobin (HbA1c) is helpful information also.

Good blood pressure control, with the systolic (bigger number) about 175mmHg; and the diastolic (lower number) less than 75mmHg, and preferably lower, is essential to protect the kidneys. Whilst this is a guide often the blood pressure has to higher to prevent symptoms of low blood pressure. Lower blood pressures may be tolerated by other people particularly young and fit people.

The best medications for blood pressure control in diabetes mellitus are [ACE \(angiotensin converting enzyme inhibitors\) inhibitors or ARBs \(angiotensin II receptor blockers\)](#). There is probably no difference in the benefits to the kidneys between these two groups of medications.

Examples of ACEIs:

- captopril, cilazapril, enalapril, lisinopril, perindopril, quinapril, ramapril, trandolapril

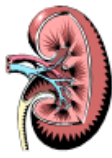
Examples of ARBs:

- candesartan, losartan

How can I minimise the risk of developing diabetic nephropathy?

1. Following a healthy lifestyle. Keeping physically active, maintaining a healthy weight, and enjoying life and doing things you enjoy with less stress.
2. Good control of blood sugar. If you have good control of your blood sugar then this reduces the damage to blood vessels and subsequently kidneys. Good control of blood sugar is not just insuring you take your medications correctly, it also include eating the right food, which may include a more balanced diet with less saturated fats, less free glucose/sugar;

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and more complex carbohydrate foods (low GI foods), a regular physical activity programme, attaining and maintaining ideal body weight.

3. Good blood pressure control. Most people with diabetic nephropathy will be on an ACE or ARB because of protein in the urine or high blood pressure or impaired kidney function. At present these are the only blood pressure medications readily available to protect your kidneys long term.

4. Controlling albuminuria (albumin or protein in the urine). This is done by ACEi and or ARB. Generally speaking dietary protein intake reduction is not advised to address albuminuria in diabetes mellitus or other protein losing conditions.

5. Controlling Cholesterol levels. Lifestyle changes, including exercise and eating a healthier diet that is lower in cholesterol and saturated fats is important as the main stay of treatment. The addition of cholesterol lowering drugs may also be required. Statins (pravastatin, simvastatin, atorvastatin, rosuvastatin) are the commonly used statins used in New Zealand. Ezetimibe (Ezetrol) is another common “safe” drug to use in kidney disease to lower cholesterol. There is no evidence that statins *per se* are toxic to the kidneys.

6. Be a non-smoker. If you currently smoke then stop permanently. If you are a non-smoker then do not start. Diabetes mellitus is a condition that aggressively damages the blood vessels. You can see this in bad diabetic sufferers who have poor blood supply to parts of their body's and have severely affected peripheral vessels (peripheral vascular disease) this leads to amputations; or if it effects the small to medium sized vessels they may have heart attacks or strokes; or the very small vessels and affects vision (including progression to blindness), the kidney vessels and result in (kidney failure) and affect the small blood vessels supporting nerves (nephropathy) resulting in loss of sensation and function. Erectile dysfunction (the inability to get an erect penis) can result from diabetic blood vessel damage as well, and no tablet medication will correct this in severe form.

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