National Kidney Foundation™

Diabetes and Chronic Kidney Disease

What is diabetes?

Diabetes mellitus, usually called diabetes or sometimes "sugar", is a condition that occurs when your body does not make enough insulin or when your body cannot use normal amounts of insulin properly. Insulin is a hormone that regulates the amount of sugar in your blood. A high blood sugar level can cause problems in many parts of your body.

Are there different types of diabetes?

Yes. The most common ones are type 1 and type 2. Type 1 diabetes is responsible for about 10 percent of the cases. It usually begins in childhood. If you have this type of diabetes, your pancreas does not make enough insulin and you have to take insulin injections.

Type 2 diabetes (the most common type of diabetes) usually occurs in people over 45, but is becoming more common in younger people. If you have this type of diabetes, your pancreas makes insulin, but your body does not use it properly. The high blood sugar level often can be controlled by weight loss, exercise and pills, but insulin may also

be needed. Type 2 diabetes is particularly common among African Americans, Hispanic Americans, Asian Americans and American Indians.

How does diabetes affect my body?

If uncontrolled, diabetes can cause damage to many parts of your body, especially your kidneys, heart, eyes and nerves. High blood pressure and hardening of the arteries (arteriosclerosis) can develop, which can lead to heart and blood vessel disease.

What does diabetes do to the kidneys?

Diabetes may damage the blood vessels in your kidneys. The first sign of kidney damage is the presence of albumin (a type of protein) in the urine. A sensitive urine test for a tiny amount of albumin (microalbuminuria) helps to detect kidney damage at an early stage in people with diabetes. Later, kidney function may decrease. Your kidney function is checked by estimating your glomerular filtration rate (GFR) from the results of your blood creatinine test. When your kidneys are damaged, they cannot clean your blood properly, and waste products build up in your blood. Your body will retain more water and salt than it should, which can result in weight gain and ankle swelling.

Diabetes also may cause damage to nerves (neuropathy) in your body. This can cause difficulty in emptying your bladder. The pressure

that results from your full bladder can back up and injure the kidneys. Also, if urine stays in your bladder for a long time, you may get a urinary tract infection. This is because bacteria grow rapidly in urine with a high sugar level.

How many people with diabetes will get chronic kidney disease?

About a third of people with diabetes may eventually develop chronic kidney disease (CKD). Certain groups, such as African Americans, Asian Americans, Hispanic Americans and American Indians may have a higher risk of getting this complication.

What can people with diabetes do to prevent kidney disease?

Maintaining good control of your blood sugar can lower your risk of getting chronic kidney disease. You should have a urine test for albumin (a type of protein) at least once a year. You should have your blood pressure checked as often as your doctor recommends, and take blood pressure medicine if your doctor orders it

for you. You should have blood tests to check your blood sugar control and to check your kidney function from your blood creatinine level. Follow your diabetic diet and get regular exercise. Avoid alcohol and cigarettes. See your doctor as often as you are told.

Many people with diabetes do not develop kidney disease. Having diabetes does not always mean your kidneys will fail. Talk to your doctor about your chances of getting chronic kidney disease.

What are the early signs of chronic kidney disease in people with diabetes?

If you have diabetes, the earliest sign of chronic kidney disease is the presence of albumin in the urine. This is present long before there is evidence of kidney disease in the usual blood tests done in your doctor's office. Albumin in the urine may also be an early sign of blood vessel abnormalities that may lead to heart disease. Thus, it is important to ask your doctor about having a urine test for a tiny amount of albumin (microalbuminuria) on a yearly basis. You should have a simple blood test for serum creatinine to estimate the filtering ability of your kidneys—called your glomerular filtration rate (GFR).

You will use the bathroom more at night. Your blood pressure may become too high. As a person with diabetes, you should have your blood, urine and blood pressure checked

regularly. This will lead to better control of your disease and early treatment of high blood pressure and kidney disease.

TABLE 1

Signs of Kidney Disease in People with Diabetes

Early Signs:

- Albumin in the urine (also indicates an increased risk for heart disease)
- Going to the bathroom more often at night
- High blood pressure

Late Signs:

- Ankle and leg swelling, leg cramps
- High levels of blood urea nitrogen (BUN) and a decrease in your glomerular filtration rate (GFR)
- Less need for insulin or anti-diabetic pills
- Weakness, paleness and anemia
- Itching
- Morning sickness, nausea and vomiting.

What are the late signs of kidney disease in people with diabetes?

Late signs may include weight gain and ankle swelling (edema). As your kidney disease progresses, you will also have a rise in your BUN and a decrease in your GFR. You may have nausea, vomiting, a loss of appetite, weakness, increasing tiredness, itching, muscle cramps (especially in your legs) and a low blood cell count (anemia). You may find you need to use less diabetes medication or insulin. This is because diseased kidneys cause less breakdown of insulin. If you have any of these signs, call your doctor.

If diabetes has affected the kidneys, what can be done?

If you have any of the signs of kidney disease listed earlier, you need to call your doctor. With blood and urine tests, your doctor can tell how your kidneys are working. This will help your doctor order the best treatment for you. Early detection of kidney disease, with the right treatment, can prevent it from getting worse.

What will happen if my kidney function is less than normal?

First, the doctor needs to find out if your diabetes has caused the injury. Other diseases can cause kidney injury. If no other problems are found, your doctor will try to keep your kidneys working as long as possible. The use of special types of high blood pressure medicine called angiotensin converting enzyme (ACE)

inhibitors and angiotensin receptor blockers (ARBs) has been shown to help slow the loss of kidney function and reduce heart disease in diabetes. The following things can help your kidneys work better and last longer:

- controlling your blood sugar with diet, exercise and medication
- controlling high blood pressure
- restricting the amount of salt in your diet to help control high blood pressure and reduce body swelling
- treatment of urinary tract infections
- correction of any problems in your urinary system
- avoiding any medication that may damage the kidneys (especially anti-inflammatory pain-relieving drugs)
- checking with your doctor before taking any herbal supplements.

How are the kidneys kept working as long as possible?

The kidney doctor (nephrologist) will plan your treatment with you, your family and your dietitian. The best ways to keep your kidneys working are controlling your blood sugar and high blood pressure with an ACE inhibitor or ARB. With diabetic kidney disease, your blood pressure should be less than 130/80. In many cases, more than one high blood pressure medication may be needed to reach this target.

You should also keep your blood sugar well controlled. A test called hemoglobin A1c is used to check your average blood sugar. Your result on this test should be less than seven percent. Restriction of protein in your diet may be helpful. You and your dietitian will plan your diet together. (See the National Kidney Foundation brochure *Nutrition and Chronic Kidney Disease*.)

What about a low-protein diet?

Research suggests that lowering the protein in your diet can slow the advance of kidney damage. You should talk to your doctor about this. If you need to go on a low-protein diet, you need to plan this with a dietitian. Do not go on this type of diet without talking to a dietitian, because it could make you sicker.

What is kidney failure in patients with diabetes?

Kidney failure means that your kidneys are no longer able to support you in a reasonably healthy state and dialysis or transplantation is needed. This happens when your kidney function is about 15 percent of normal. Without proper treatment, the time between the beginning of diabetic kidney damage and end stage kidney failure is about five to seven years.

How is kidney failure treated in diabetic patients?

Three types of treatment can be used once your kidneys have failed: kidney transplantation, hemodialysis or peritoneal dialysis. The type of treatment for you will be chosen

according to your general health and medical condition, your lifestyle and your treatment preference. The success rate of each treatment type is very important in this planning. These decisions are not final. Many people have used each one of these treatments at different times. Your health care team will discuss these different treatments with you and answer your questions.

Can a patient with diabetes have a kidney transplant?

Yes. A kidney transplant can come from someone who has died, or from a living donor who may be a close relative, friend or even a stranger who wished to donate a kidney to anyone in need of a transplant. Once you get a new kidney, you may need to use a higher dose of insulin. This is because you will be eating more and your new kidney will break down insulin better than your injured one. You will also be using medications called steroids to keep your body from rejecting your new kidney. If your transplanted kidney loses function, dialysis treatment can be started and you can wait for another transplant. (See the National Kidney Foundation brochure *Kidney Transplant*.)

What about kidney-pancreas transplants?

Sometimes, if you have type 1 diabetes, it may be possible to perform a pancreas transplant at the same time as a kidney transplant or soon afterwards. Your doctor can advise you regarding this possibility.

What does hemodialysis involve?

Hemodialysis is the most common form of treatment for kidney failure. In order to have hemodialysis, you will need to have surgery to join one of your arteries in your arm to a nearby vein. This will create a bigger vein called a fistula. Needles are inserted into the fistula and connected by tubes to the artificial kidney machine. This machine cleans the blood and removes waste products that build up in your blood.

The treatments last about four hours and usually need to be done three times a week. Dialysis can be done in a hospital, an outpatient dialysis clinic or at home (after training). (See the National Kidney Foundation brochure *Hemodialysis*.)

What does peritoneal dialysis involve?

Peritoneal dialysis is used often in patients with diabetes. In this type of dialysis, the patient's blood is not cleaned outside the body as with hemodialysis. The blood stays in the blood vessels that line your own abdominal (peritoneal) space. The lining of this space acts like a natural filter.

A plastic tube called a catheter is placed into your abdomen by a surgical procedure. During treatment, your abdomen (through the catheter) is slowly filled with fluid called dialysate. Wastes filter out of the blood vessels lining your abdominal space and go into the dialysate fluid. Once the process is finished, the used dialysate is drained out and discarded. This process is then repeated (usually four to six times during the day or night). Several kinds of peritoneal dialysis can be done. (See the National Kidney Foundation brochure *What You Need to Know About Peritoneal Dialysis*.)

Key points to remember about diabetes and the kidneys:

- Severe kidney failure may occur in about a third of people with diabetes.
- Because diabetes may injure the blood vessels in the body, it can cause permanent kidney damage. The earliest sign of kidney damage is the pressure of albumin in the urine.
- The presence of kidney damage and the level of kidney function (GFR) indicate chronic kidney disease.
- Early kidney damage by diabetes can be detected by a sensitive test for a tiny amount of albumin in the urine (microalbuminuria). A blood test for creatinine may be used to estimate your GFR, which tells how much kidney function you have.

- Reaching your target blood pressure with the help of ACE inhibitors or angiotensin receptor blockers is the most effective way to slow the loss of kidney function.
- Reducing the amount of salt in your diet may be needed if there is kidney damage, body swelling or high blood pressure.
- Other factors can cause kidney damage and affect kidney function. These are: blocking of urine flow, urinary tract infections and certain medications (especially anti-inflammatory pain-relieving medication).
- Ankle and leg swelling (edema), going to the bathroom more often at night, high blood pressure and a decrease in the amount of insulin needed to control diabetes may all be signs of kidney damage.
- If chronic kidney disease gets worse and causes kidney failure, this can be treated by kidney transplantation, hemodialysis or peritoneal dialysis. The type of treatment is chosen for every patient, depending on overall health, lifestyle and personal preference. A treatment plan may use each of these forms of therapy at one time or another.
- The diabetic diet is a very important part of the treatment of all patients with diabetes, even if they do not have chronic kidney disease.

Other Resources

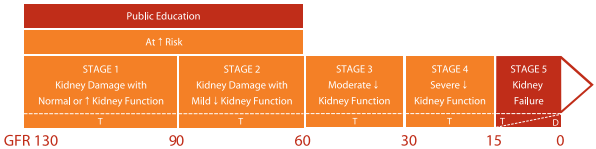
You may also be interested in these other publications from the National Kidney Foundation:

- *Your Kidneys: Master Chemists of the Body*
- *High Blood Pressure and Chronic Kidney Disease (Stages 1-4)*
- *About Chronic Kidney Disease: A Guide for Patients and Their Families*
- *Are You at Increased Risk for Chronic Kidney Disease?*
- *What You Need to Know About Urinalysis*
- *Nutrition and Chronic Kidney Disease*
- *What You Need to Know When You Have Chronic Kidney Disease*
- *Choosing a Treatment for Kidney Failure*
- *Hemodialysis*
- *What You Need to Know About Peritoneal Dialysis*
- *Kidney Transplant*

To obtain copies of these publications or information about other National Kidney Foundation resources, contact your local National Kidney Foundation affiliate, or call the national toll-free number 800.622.9010. Also, visit the NKF's Kidney Learning System (KLS) Web site at www.kidney.org/KLS

More than 20 million Americans—one in nine adults—have chronic kidney disease, and most don't even know it. More than 20 million others are at increased risk. The National Kidney Foundation, a major voluntary health organization, seeks to prevent kidney and urinary tract diseases, improve the health and well-being of individuals and families affected by these diseases, and increase the availability of all organs for transplantation. Through its 47 affiliates nationwide, the foundation conducts programs in research, professional education, patient and community services, public education and organ donation. The work of the National Kidney Foundation is funded by public donations.

Education Along the Continuum of Care



This arrow illustrates the potential scope of content for KLS resources.
Lightshaded boxes indicate the scope of content targeted in this resource.
GFR = Glomerular Filtration Rate; T = Kidney Transplant; D = Dialysis

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National Kidney Foundation
30 East 33rd Street
New York, NY 10016
800.622.9010

www.kidney.org

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