Patient education: Diabetic kidney disease (Beyond the Basics)

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DIABETIC KIDNEY DISEASE OVERVIEW

People with diabetes have a lot to juggle when it comes to their health care. Having diabetes puts you at risk of other health problems, including heart attacks, strokes, vision loss, nerve damage, and kidney disease. While all of that may sound overwhelming, there is some good news; many of the steps you need to take to prevent one of those complications may actually help to prevent them all.

This article will discuss the early signs of diabetic kidney disease. People who develop diabetic kidney disease usually have no symptoms early on, although the condition puts them at risk of developing more serious kidney disease.

The kidneys play an important role in the body: they filter the blood, removing waste products and excess salt and water. If the kidneys become diseased, they falter in their task, leaving the blood polluted.

Finding out that you have early diabetic kidney disease can alert you that your kidneys are in danger. It is important to take steps to protect your kidneys before the problem advances. Information about advanced kidney disease is also available. (See "Patient education: Chronic kidney disease (Beyond the Basics)".)

In some cases, diabetic kidney disease can eventually cause the kidneys to stop working altogether. If that happens to you, you will need to have a kidney transplant or dialysis, a procedure that filters the blood artificially several times a week. Also, if your kidneys are

diseased, your risk of heart attacks and heart failure could be higher. (See "Patient education: Dialysis or kidney transplantation — which is right for me? (Beyond the Basics)".)

DIABETIC KIDNEY DISEASE SYMPTOMS

Diabetic kidney disease commonly causes no symptoms until at least 80 percent of your kidneys' function is lost. To detect diabetic kidney disease, health care providers rely on tests that measure protein (albumin) levels in the urine and blood tests to evaluate the level of kidney function.

When the kidneys are working normally, they prevent albumin from leaking into the urine, so finding albumin in the urine is a sign that the kidneys are in trouble. Often people who have diabetic kidney disease also have high blood pressure.

DIABETIC KIDNEY DISEASE RISK FACTORS

Having a family history of kidney disease or belonging to certain ethnic groups (eg, African American, Mexican, Pima Indian) can increase your risk of diabetic kidney disease. Although you cannot do anything to change your family history, there are several factors that increase your risk of developing diabetic kidney disease that you can change and control. These include:

- Having chronically elevated blood sugar levels
- Being overweight or obese
- Smoking
- Having high blood pressure
- Having high cholesterol
- Having a diabetes-related vision problem (diabetic retinopathy) or nerve damage (diabetic neuropathy) (see "Patient education: Diabetic neuropathy (Beyond the Basics)")

DIABETIC KIDNEY DISEASE DIAGNOSIS

Urine tests are recommended once per year in people with type 1 diabetes, beginning about five years after diagnosis, and in people with type 2 diabetes, starting at the time of diagnosis.

The urine test is looking for a protein called albumin. If there is a small amount, it indicates a higher than average risk of developing heart disease. However, if a large amount of albumin is present, it means you have diabetic kidney disease. You may be told that you have

"microalbuminuria" or "moderately increased albuminuria." That simply means that you have small amounts of albumin in your urine, but it still means that you are at risk for getting diabetic kidney disease, assuming you do not have kidney disease caused by another condition. (See "Patient education: Protein in the urine (proteinuria) (Beyond the Basics)".)

The same urine test that is used to diagnose diabetic kidney disease will also be used to monitor your condition over time. (See 'Ongoing monitoring' below.)

DIABETIC KIDNEY DISEASE COMPLICATIONS

The key complication of diabetic kidney disease is more advanced kidney disease, called chronic kidney disease. (See "Patient education: Chronic kidney disease (Beyond the Basics)".)

Chronic kidney disease can, in turn, progress even further, eventually leading to total kidney failure and the need for dialysis or kidney transplantation. (See "Patient education: Dialysis or kidney transplantation — which is right for me? (Beyond the Basics)".)

DIABETIC KIDNEY DISEASE TREATMENT

People with diabetes often focus on keeping their blood sugar levels in the right ranges. And while it is important to control blood sugar, it turns out that controlling blood pressure is at least as important. That's because high blood sugar and high blood pressure work in concert to damage the blood vessels and organ systems.

For these reasons, the most important things you can do to stall kidney disease and protect against other diabetes complications are to:

- Make healthy lifestyle choices
- Keep your blood sugar as close to normal as possible (see 'Blood sugar control' below)
- Keep your blood pressure below 130/80, if possible (see 'Managing high blood pressure' below)

Most people with type 2 diabetes and kidney disease should be treated with a sodium-glucose cotransporter 2 (SGLT2) inhibitor. If there is still albumin in the urine after treatment with appropriate blood pressure medicines and an SGLT2 inhibitor, then a drug called finerenone should also be used. (See 'SGLT2 inhibitors' below.)

Lifestyle changes — Changing your lifestyle can have a big impact on the health of your kidneys. The following measures are recommended for everyone, but are especially important if you have diabetic kidney disease:

- Limit the amount of sodium (salt) you eat to less than 2 grams per day) (see "Patient education: Low-sodium diet (Beyond the Basics)")

- If you smoke, quit smoking (see "Patient education: Quitting smoking (Beyond the Basics)")

- Lose weight if you are overweight (see "Patient education: Diet and health (Beyond the Basics)" and "Patient education: Exercise (Beyond the Basics)" and "Patient education: Losing weight (Beyond the Basics)")

Blood sugar control — Keeping blood sugars close to normal can help prevent the long-term complications of diabetes mellitus. For most people, a target for fasting blood glucose and for blood glucose levels before each meal is 80 to 120 mg/dL (4.4 to 6.6 mmol/L); however, these targets may need to be individualized. (See "Patient education: Glucose monitoring in diabetes (Beyond the Basics)".)

A blood test called A1C is also used to monitor blood sugar levels; the result provides an average of blood sugar levels over the last one to three months. An A1C of 7 percent or less is usually recommended; this corresponds to an average blood glucose of 150 mg/dL (8.3 mmol/L) (table 1). Even small decreases in the A1C lower the risk of diabetes-related complications to some degree.

Managing your blood sugar involves lifestyle changes (eg, diet and exercise) as well as medications. Type 1 diabetes is treated with insulin. For type 2 diabetes, other medications are often used; some are not recommended for use in people with kidney problems, while others may help slow the progression of kidney disease. Your doctors will work with you to determine what combination of medications is best for you.

Managing high blood pressure — Many people with diabetes have hypertension (high blood pressure). Although high blood pressure causes few symptoms, it has two negative effects: it stresses the cardiovascular system and speeds the development of diabetic complications of the kidney and eye. A health care provider can diagnose high blood pressure by measuring blood pressure on a regular basis. (See "Patient education: High blood pressure in adults (Beyond the Basics)".)

The treatment of high blood pressure varies. If you have mild hypertension, your health care provider may recommend weight loss, exercise, decreasing the amount of salt in the diet, quitting smoking, and decreasing alcohol intake. These measures can sometimes reduce blood pressure to normal. (See "Patient education: High blood pressure, diet, and weight (Beyond the Basics)".)

If these measures are not effective or your blood pressure needs to be lowered quickly, your provider will likely recommend one of several high blood pressure medications. Your

provider can discuss the pros and cons of each medication and the goals of treatment. (See "Patient education: High blood pressure treatment in adults (Beyond the Basics)".)

A blood pressure reading below 130/80 is the recommended goal for most people with diabetic kidney disease, especially if you have more than 300 mg of albumin in your urine per day.

Blood pressure medications — All people with diabetic kidney disease need at least one medication to lower their blood pressure, and in most cases two medications are needed. Several medications can be used for this purpose, but a medication known as an angiotensin-converting enzyme inhibitor (abbreviated ACE inhibitor) or a related drug known as an angiotensin receptor blocker (ARB) should be used because they limit the worsening of kidney disease.

ACE inhibitors and ARBs are particularly useful for people with diabetic kidney disease because they decrease the amount of albumin in the urine and can prevent or slow the progression of diabetes-related kidney disease. In fact, the kidney benefits of ACE inhibitors and ARBs are so robust that health care providers sometimes prescribe them for people with diabetic kidney disease who have normal blood pressure.

Still, despite their kidney-protecting abilities, ACE inhibitors and ARBs do have their downsides. For instance, ACE inhibitors cause a persistent dry cough in 5 to 20 percent of the people who take them, even up to 50 percent among Asian populations. Some people get used to the cough; others find it so disruptive that they cannot continue taking an ACE inhibitor. For them, ARBs are often a good alternative, because ARBs do not cause a cough.

In rare cases, you can have more serious side effects with ACE inhibitors and ARBs. These include a condition called hyperkalemia, in which too much potassium accumulates in the blood. To monitor for these and other side effects, health care providers sometimes run blood tests soon after starting these drugs. In some people, the medications will need to be stopped.

SGLT2 inhibitors — In addition to the measures described above, some people with **type 2** diabetes and kidney disease will get a medication called a sodium-glucose cotransporter 2 (SGLT2) inhibitor. These medications lower blood sugar by increasing the excretion of sugar in the urine in people with good kidney function; they include canagliflozin (brand name: Invokana), empagliflozin (brand name: Jardiance), and dapagliflozin (brand name: Farxiga).

In people with reduced kidney function, they should be used because they reduce the risk of worsening kidney disease and risk of developing heart failure.

Ongoing monitoring — After beginning treatment and lifestyle changes to stall kidney disease, you will need to have repeat urine and blood tests to determine if urine albumin

levels have improved. If the urine albumin levels have not improved or your kidney function has worsened, your health care provider may need to adjust your medications or recommend other strategies to protect your kidneys.

PREGNANCY AND DIABETIC KIDNEY DISEASE

If you have diabetes and are interested in getting pregnant, it is important to talk with your health care provider well in advance, especially if you have diabetic kidney disease. Diabetes and its attendant problems can increase the risk of complications in pregnancy, especially in women with decreased kidney function. However, many women with mild diabetic kidney disease have normal pregnancies and healthy babies.

To ensure the best outcome with a pregnancy, the most important thing you can do is to keep your blood sugar and blood pressure under tight control. However, women who are pregnant or attempting to get pregnant should not take angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs), as these drugs can cause birth defects. Instead, other medications (such as calcium channel blockers) are used during pregnancy to keep the blood pressure in check. (See "Patient education: Care during pregnancy for patients with type 1 or 2 diabetes (Beyond the Basics)".)

DIABETIC KIDNEY DISEASE AND OTHER DIABETES COMPLICATIONS

If the steps you need to take to protect your kidneys sound overwhelming, keep this in mind; controlling your blood sugar and blood pressure can help to reduce the risk or severity of several other debilitating diabetes complications, including:

- Reduced vision or potential visual loss (due to diabetic retinopathy)
- Nerve damage (called diabetic neuropathy)
- Stroke and heart attack (both of which can be fatal)

DIABETIC KIDNEY DISEASE PREVENTION

The same measures that are used in the treatment of diabetic kidney disease are also useful in preventing it. That's true for the lifestyle choices mentioned above, as well as for the tight control of blood sugar levels and blood pressure.

WHERE TO GET MORE INFORMATION

Your health care provider is the best source of information for questions and concerns related to your medical problem.

This article will be updated as needed on our web site (www.uptodate.com/patients). Related topics for patients, as well as selected articles written for health care professionals, are also available. Some of the most relevant are listed below.

Patient level information — UpToDate offers two types of patient education materials.

The Basics — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

Patient education: Type 2 diabetes (The Basics)

Beyond the Basics — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

Patient education: Chronic kidney disease (Beyond the Basics)
Patient education: Dialysis or kidney transplantation — which is right for me? (Beyond the Basics)
Patient education: Diabetic neuropathy (Beyond the Basics)
Patient education: Protein in the urine (proteinuria) (Beyond the Basics)
Patient education: Low-sodium diet (Beyond the Basics)
Patient education: Quitting smoking (Beyond the Basics)
Patient education: Diet and health (Beyond the Basics)
Patient education: Exercise (Beyond the Basics)
Patient education: Losing weight (Beyond the Basics)
Patient education: Glucose monitoring in diabetes (Beyond the Basics)
Patient education: High blood pressure in adults (Beyond the Basics)
Patient education: High blood pressure, diet, and weight (Beyond the Basics)
Patient education: High blood pressure treatment in adults (Beyond the Basics)
Patient education: Care during pregnancy for patients with type 1 or 2 diabetes (Beyond the Basics)

Professional level information — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

Antihypertensive therapy and progression of nondiabetic chronic kidney disease in adults
Moderately increased albuminuria (microalbuminuria) in type 1 diabetes mellitus
Moderately increased albuminuria (microalbuminuria) in type 2 diabetes mellitus
Diabetic kidney disease: Pathogenesis and epidemiology
Kidney transplantation in diabetic kidney disease
Treatment of diabetic kidney disease
Major side effects of angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers
Pregnancy and contraception in patients with nondialysis chronic kidney disease

The following organizations also provide reliable health information:

- National Library of Medicine

(www.nlm.nih.gov/medlineplus/healthtopics.html)

- National Institute of Diabetes and Digestive and Kidney Diseases

(www.niddk.nih.gov)

- American Diabetes Association (ADA)
(800)-DIABETES (800-342-2383)
(www.diabetes.org)

- The Hormone Health Network

(www.hormone.org/diseases-and-conditions/diabetes, available in English and Spanish)

[1-7]

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We are saddened by the death of George Bakris, MD, who passed away in June 2024. UpToDate acknowledges Dr. Bakris's past work as an author for this topic.

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GRAPHICS

A1C level and average blood sugar

If your A1C level is (percent):	That means your average blood sugar level during the past 2 to 3 months was about:	
	If you live *in the US*, use these values. **Your blood sugar is measured in milligrams/deciliter (mg/dL).**	**If you live *outside the US*, use these values.** **Your blood sugar is measured in millimoles/liter (mmol/L).**
5	97	5.4
6	126	7
7	154	8.6
8	183	10.2
9	212	11.8
10	240	13.3
11	269	15
12	298	16.5
13	326	18.1
14	355	19.7

The A1C blood test tells you what your average blood sugar level has been for the past 2 to 3 months. This table lists which A1C levels go with which average blood sugar levels. Blood sugar is measured differently in the US than it is in most other countries. The column in the middle is for people in the US. The column on the right is for people who live outside the US.

A1C: glycated hemoglobin.

Graphic 76310 Version 5.0