

MINERAL AND BONE DISORDER

*If you have kidney disease
or kidney failure*



National
Kidney
Foundation®

www.kidney.org

About the Information in this Booklet

Did you know that the National Kidney Foundation (NKF) offers guidelines and commentaries that help your healthcare provider make decisions about your medical treatment? The information in this booklet is based on those recommended guidelines.

Stages of Kidney Disease

There are five stages of kidney disease. They are shown in the table below. Your healthcare provider determines your stage of kidney disease, based on the presence of kidney damage and your glomerular filtration rate (GFR), which is a measure of your kidney function. Your treatment is based on your stage of kidney disease. Speak to your healthcare provider if you have any questions about your stage of kidney disease or your treatment.

STAGES OF KIDNEY DISEASE

Stage	Description	Glomerular Filtration Rate (GFR)*
1	Kidney damage (e.g., protein in the urine) with normal GFR	90 or above
2	Kidney damage with mild decrease in GFR	60 to 89
3	Moderate decrease in GFR	30 to 59
4	Severe reduction in GFR	15 to 29
5	Kidney failure	Less than 15

*Your GFR number tells your healthcare provider how much kidney function you have. As chronic kidney disease progresses, your GFR number decreases.

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Introduction

Healthy kidneys do many important jobs. They remove wastes and extra fluid from your body, help make red blood cells, and help keep bones strong. They also help to keep the right amount of minerals in your blood. Minerals are nutrients that your body needs to stay healthy.

When you have kidney disease, your kidneys cannot do these important jobs well. As a result, you may develop mineral and bone disorder. It is a common problem in people with kidney disease and it affects almost everyone receiving dialysis.

What is mineral and bone disorder?

Kidney disease and kidney failure can cause important minerals in your blood stream, such as calcium and phosphorus, to get out of balance. Minerals are nutrients that your body needs. As a result, bones may lose calcium and become weak over time. Some calcium and phosphorus may end up in parts of your body where they do not belong, like your heart and blood vessels. This can lead to heart disease. Finding and treating mineral and bone disorder is important. It will help you keep your bones and heart healthy.

Do you know these words?

Some medical words that are used in this booklet may be new to you. To help you get to know them, there's a list of "Words to Know" at the end of this booklet. (Page 21.)

When do bone problems begin?

Bone problems begin in the early stages of kidney disease. Changes can be happening and you may not feel any symptoms. Children can have mineral and bone disorder, too. Children are still growing, so bone growth and height can be affected.

How does kidney disease affect bones?

Maintaining strong and healthy bones is a complicated process. New bone cells are made and old bone cells are replaced every day. This is called “bone turnover.” The amount of bone cells you have in your bones affects how strong they are. With kidney disease, your kidneys are not working as well as they should. Kidney disease changes the normal process of bone turnover. Kidneys can’t release the hormones that help your body make strong bones. Hormones are chemical messengers that tell your body to do many important things.

The kidneys also have a hard time keeping important minerals like phosphorus and calcium in balance. Minerals are nutrients that you get from the food you eat. When kidneys can’t do these things, you have mineral and bone disorder.

Healthy Bones Are Always Changing

Many people think of bones as simple, hard objects — like stone, for example. In fact, bones are a living, changing part of the body. Old layers of bone are always being replaced by new bone. Strong, healthy bones need the right balance of calcium and phosphorus.

What happens when you have mineral and bone disorder?

When you have mineral and bone disorder, it affects how your body releases important hormones that help keep your bones strong. It also affects how your body balances two important minerals—calcium and phosphorus.

Your body needs calcium to build bones, control blood pressure, and keep a normal heart beat. Calcium comes into your body when you eat foods with calcium, like milk and other dairy products. Most of the body's calcium is in bones and teeth. Healthy kidneys help to keep the right level of calcium in your body.

Phosphorus is another important mineral in your body. Phosphorus has many jobs. It helps with growth and energy. You get phosphorus in many foods you eat. In adults, most of the body's phosphorus is in the bones. Healthy kidneys get rid of the phosphorus you don't need.

Your body also has problems releasing certain hormones, like "active" vitamin D and parathyroid hormone (PTH). "Active" vitamin D helps your kidneys, bones, and intestines balance phosphorus and calcium. Healthy kidneys change the vitamin D you get from sunlight and the foods you eat into "active" vitamin D. But with mineral and bone disorder, your kidneys can't change vitamin D into "active" vitamin D.

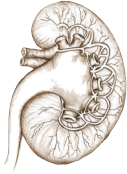
Without active vitamin D, people with mineral and bone disorder can't keep the right balance of calcium and phosphorus in the body. Calcium will be too low and phosphorus will be too high.

Parathyroid hormone (PTH) is another hormone that helps to keep the right balance of calcium in the bones and in the blood. When the level of phosphorus in the blood goes up and level of “active” vitamin D goes down, your body makes too much PTH. High PTH causes calcium to leave your bones and go into your blood. As more and more calcium leaves your bones, they become weaker, more brittle, and may break more easily.

Is mineral and bone disorder connected to heart problems?

It may be. The same problems that weaken bones may also cause minerals like calcium and phosphorus to build-up in your heart and blood vessels. As a result, your heart and blood vessels can become stiff and narrow. This increases your risk of heart failure, heart attack, and several other problems.

How Kidney Disease Can Lead to Bone and Heart Disease



When you have kidney disease...



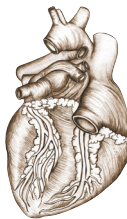
...calcium and phosphorus levels are out of balance. When phosphorus goes up, the level of active vitamin D goes down...



...parathyroid glands make too much PTH...



...high PTH levels in your blood cause calcium to leave your bones. Bones become weaker...



...some calcium may end up in the heart and blood vessels. This may lead to heart disease.

Is osteoporosis different from mineral and bone disorder?

Yes. Both are diseases of the bones, but they are different diseases. Both cause bones to become weaker and break more easily. However, the causes and treatments are different.

Osteoporosis happens in some people as they age. It is most common in women after menopause. Some people have both osteoporosis and mineral and bone disorder. To learn more, ask your healthcare provider.

If there are no early symptoms of mineral and bone disorder, how do you know if you have it?

Blood tests can measure the amount of calcium, phosphorus, “active” vitamin D, and PTH in your blood. This helps determine whether you have mineral and bone disorder.

How often these tests are done is different for different people.

TIP

Know your lab results for calcium, phosphorus, and other important tests. If any of these tests are ordered, ask about the results of your blood tests. Write down the numbers in a lab tracking sheet. You can see how the results change over time. To download a lab tracking sheet, go to www.kidney.org/AtoZGuide.

What tests tell about heart and blood vessel problems?

Some people may need an x-ray to look at the blood vessels and heart for signs of “hardening” and deposits of calcium. Another test called an echocardiogram may be done if there is a concern about heart problems caused by mineral and bone disorder. Not all people will need these tests.

How is mineral and bone disorder treated?

Once mineral and bone disorder is found, diet and certain medications may help slow down the loss of bone and the buildup of minerals in blood vessels and the heart. Treatment will be based on the results of your tests and how quickly the results are changing.

If the results change over time, your treatment may change.

- Diet is important for controlling minerals.
- Vitamins, supplements, and medicines may be prescribed.

Also, treatment to control parathyroid hormone (PTH) may be needed. The goal is to slow down overactive parathyroid glands that make too much PTH. These glands can be made less active with medicine. In some cases, surgery may be needed if other treatments are not effective. This surgery (parathyroidectomy) removes the parathyroid glands that make PTH.

Which medicines might be prescribed in mineral and bone disorder?

Common medicines for mineral and bone disorder are:

- **Phosphate binders.** If a lower-phosphorus diet does not control your blood phosphorus, you may need a medicine called a phosphate binder.
- **Active vitamin D.** If your vitamin D level is low, you may need a prescription form of active vitamin D. (If you have kidney failure and are receiving hemodialysis, your vitamin D may be given to you during your dialysis treatment.)
- **Calcimimetics.** Your healthcare provider may prescribe another medicine called a calcimimetic to help control mineral and bone disorder. It works differently from phosphate binders and vitamin D. It is often used when PTH, calcium, and phosphorus levels are too high.
- **Calcium supplements.** Your healthcare provider will decide if you need calcium supplements. Do not take them on your own. *Note:* If you are receiving dialysis, it's important to know that the dialysis fluid contains calcium. Your healthcare provider will look at all the medicines you are taking for bone and mineral disorder to decide if changing the amount of calcium in your dialysis fluid could help you.
- **Osteoporosis medicines.** Some patients have both mineral and bone disorder and the bone disease osteoporosis. Osteoporosis medicines are not always prescribed for people with kidney disease, but they may help some people.

More About Phosphate Binders

These medicines help to keep phosphorus at the right level. Phosphate binders help stop phosphorus in foods you eat from getting into your blood. They “bind” to the phosphorus while it is in your digestive system. This helps your body get rid of phosphorus.

Not all people with mineral and bone disorder need a phosphate binder. If you have high levels of phosphorus, your healthcare provider will talk to you about the pros and cons of using phosphate binders.

Phosphate binders are not all alike. You should speak to your healthcare provider about which type of binder is best for you.

To work best, your phosphate binders should be taken with food or within 10 to 15 minutes of eating. However, if you forget, be sure to take them even if you are a little late.

You should take phosphate binders as instructed by your healthcare provider or dietitian. Using phosphate binders does not take the place of your lower phosphorus diet. You still have to make low-phosphorus food choices.

Which medicines replace active vitamin D?

Synthetic forms of active vitamin D are available as pills or injections. There are several types that might be used. Do not substitute for what your healthcare provider orders. Because each type of vitamin D is a little different, your healthcare provider will decide which type is best for you. If you have kidney failure and are receiving hemodialysis, your vitamin D may be given to you during your dialysis treatment.

What about calcium supplements?

Some people need to take calcium supplements. Others do not. Do not take calcium supplements without checking with your healthcare provider. Results of your blood tests will guide your healthcare provider's decisions about whether or not you need extra calcium.

A lower phosphorus diet limits dairy foods, which are high in calcium. You need to speak to professionals who will explain how to make the healthiest food choices. A registered dietitian can help make a food plan that balances your needs for calcium, protein, and phosphorus.

Some phosphate binders also contain calcium. This is why it is important not to take medicines, vitamins, supplements, or herbal pills without your healthcare provider knowing. For example, antacids can have calcium or other minerals. Before you use any antacids, ask your healthcare provider.

How will food choices change if you have mineral and bone disorder?

Making the right food choices for mineral and bone disorder may be complicated. In general, people with mineral and bone disorder need to limit high-phosphorus foods. They need to get the right amount of calcium, too. They also have to be sure to get the right amount of protein.

Foods with phosphate additives also tend to raise blood phosphorus levels. This is because this type of phosphorus is easier for your body to absorb or "soak up" than the phosphorus found naturally in foods. Phosphorus additives are in most processed and fast foods. Avoiding these foods will help control your blood phosphorus level.

It's best to check with your healthcare provider or dietitian about what you need to do to change your diet. It's also important to read the label on the foods you buy.

Keep these tips in mind:

- Many foods have phosphorus. (See table on page 19.)
- Canned foods, frozen foods, or foods that come in boxes may have added phosphorus. Processed foods (prepared meals found in the freezer, a box, or a can) may have added phosphorus.
- Read food labels to see if they contain phosphorus additives. You might see words like "sodium phosphate" or "pyrophosphate." Ask your healthcare team about any ingredients that have a word with "phos" in it.
- Learn ways to lower the amount of phosphorus in your favorite recipes.

- Look for food labels that say “added calcium” or “fortified” with calcium. Be sure that you know what this may mean for you.

Special Occasions and Eating Out

When you are not the cook, you still have to make good choices. You can go to restaurants or parties without overloading on phosphorus.

- Ask for sauces and dressing on the side.
- Limit foods that are “creamed,” “scalloped,” or “au gratin.”
- Choose drinks that are not “colas.”
- Eat smaller amounts. Ask for a container to take home your extra food. Share your meal with a friend.
- Know the changes you need to make to limit high-phosphorus choices at restaurants and fast food chains.

TIP

Take steps to prevent falls. People with kidney disease or kidney failure may have a greater risk of injuries from falling. With weaker bones, falls can result in fractures.

- Make your home safer by removing things you can trip on
- Remove hazards like throw rugs and clutter
- Improve lighting
- Wear nonslip shoes
- Install handrails

Key Points to Remember

- Mineral and bone disorder happens when the kidneys fail to keep the right amounts of calcium and phosphorus in your blood.
- Mineral and bone disorder is a common problem in people with kidney disease and affects almost all patients receiving dialysis.
- If calcium levels in the blood become too low, or phosphorus levels too high, four small glands in the neck called the parathyroid glands release a hormone called parathyroid hormone (PTH). This hormone draws calcium and phosphorus from the bones and puts them into the blood stream. When this happens, bones become weaker and painful.
- Some of this calcium can end up in the heart and blood vessels. This increases your risk for heart disease and stroke.

- Choosing foods that are lower in phosphorus can help you manage bone disease. Medications called phosphate binders might also be needed with meals and snacks to bind phosphorus in the bowel. Other medications might also be needed.
- Finding and treating mineral and bone disorder early will help you keep your bones and heart healthy.

Where can you get more information?

If you have more questions, speak with your healthcare team. They know you and can answer questions about your care.

If you want to read more about kidney disease, the National Kidney Foundation has many other booklets that cover many subjects:

- Risk factors for kidney disease, like high blood pressure and diabetes
- Complications of kidney disease, like heart disease and anemia
- Information about diet and nutrition
- Treating kidney failure with kidney transplant or dialysis

There are two ways to learn about the many free resources available to you from the National Kidney Foundation:

- Learn more at **www.kidney.org**
- Call the NKF Cares Patient Help Line at **855.NKF.Cares** (855.653.2273) or email **nkfcares@kidney.org**

Becoming an educated patient is very important to being healthy!

High-Phosphorus Foods to Limit or Avoid

Drinks	Ale, beer Canned or bottled iced teas Cocoa; chocolate drinks Dark colas Drinks made with milk, yogurt, buttermilk
Dairy Products	Cottage cheese; ricotta cheese Cream soups Custard Hard cheese (parmesan, Swiss, cheddar) Ice cream Milk Pudding Yogurt
Protein	Canned tuna and salmon Crayfish Organ meats (liver, kidneys, sweetbreads) Oysters, clams, calamari, crab Processed meats (hot dogs, canned meat) Sardines Tofu
Dried Beans and Peas	Beans (pinto, black, kidney, cannelloni, lima, etc.) Canned beans (baked beans, pork and beans, etc.) Lentils or soy beans Peas (chick peas, split peas, black-eyed peas) Soups or other foods made with beans, lentils, and chick peas, like chili or hummus
Nuts and Seeds	Almonds, cashews, pistachios, sunflower seeds, peanuts, peanut butter
Other High-Phosphorus Foods	Bran cereals Brewer's yeast Chocolate and candies made from milk (caramels) Oatmeal Quick breads, biscuits, corn bread, muffins, pancakes or waffles from boxed mixes Wheat germ Whole grain products Processed and fast foods with phosphate additives

Note: This list is not complete.

Food Choices with Less Phosphorus

Instead of these high-phosphorus foods:	Try these low-phosphorus foods:
1 cup milk (230 mg phosphorus)*	1/2 cup milk (115 mg)
1 cup cream soup made with milk (275 mg)	1 cup cream soup made with water (90 mg)
1 ounce hard cheese, such as American, cheddar, muenster, Swiss (145 mg)	1 ounce cream cheese (30 mg)
1/2 cup ice cream (80 mg)	1/2 cup sherbet or 1 popsicle (0 mg)
12 ounce can of cola (55 mg)	12 ounce can of non-cola, such as ginger ale or lemon soda (3 mg)
1/2 cup lima or pinto beans (100 mg)	1/2 cup mixed vegetables or green beans (35 mg)
1/2 cup pudding or custard made with milk (150 mg)	1/2 cup gelatin dessert (30 mg)
1/2 cup nuts (200 mg)	1 1/2 cups light salted/low-fat popcorn (35 mg)
1 1/2 ounce chocolate bar (125 mg)	1 1/2 ounce hard candy in fruit flavors or jelly beans (3 mg)
2/3 cup oatmeal (130 mg)	2/3 cup cream of wheat, cream of rice or grits (40 mg)
1/2 cup bran cereal (140–260 mg)	1/2 cup non-bran cereal, rice cereal or corn flakes (50–100 mg)

**The numbers are the milligrams of phosphorus in the food.*

Words to Know

Active vitamin D: Vitamin D comes from some foods and the sun. To be used by your body, it first must be made into its active form. Healthy kidneys do this. Active vitamin D can also be given as a medicine. Another name for this is "calcitriol."

Bone turnover: A process in which new bone cells are made by your body and old bones cells are replaced.

Calcium: A mineral needed for healthy bones. Calcium can be lost from your bones when you have kidney disease or kidney failure. Too much calcium in the blood can damage the blood vessels and heart.

Dialysis: A process that filters waste products and extra fluid from your blood when your kidneys are no longer doing their job. There are two types of dialysis — hemodialysis and peritoneal dialysis.

Dietitian: A professional with special training to help you plan what to eat and drink to help you feel your best.

Echocardiogram: A test that uses sound waves to create a moving picture of the heart.

Hormones: Chemical "messengers" produced by many different glands in your body — including the kidneys — to trigger certain responses in your body.

Kidney disease: The loss of some or all of your kidney function. Kidney disease can result from conditions such as high blood pressure, diabetes, family history, or an injury to the kidneys.

Kidney failure: The stage of kidney disease at which dialysis or a transplant is needed to stay alive.

Kidney transplant: An operation that places a healthy kidney in your body. It is one of the basic forms of treatment for kidney failure.

Mineral and bone disorder: Kidney disease and kidney failure can cause important minerals, such as calcium and phosphorus, to build up in your blood stream and get out of balance. As a result, bones may lose calcium and become weak over time. Some calcium and phosphorus may end up in parts of your body where they do not belong, like your heart and blood vessels. This can lead to heart disease.

Minerals: Minerals, such as calcium and phosphorus, are nutrients that you get from food. Your body needs them to work properly and stay healthy.

Nutrients: Chemicals that you get from food that are necessary to live and grow. They are used to build and repair tissues, regulate body processes, and for energy. Vitamins, minerals, and protein are nutrients.

Osteoporosis: A disorder in which the bones weaken and become brittle, fracture easily, and heal slowly. It is very common in older women.

Parathyroid hormone (PTH): A hormone that affects the balance of calcium and phosphorus levels in your blood. Also called “PTH.”

Phosphate binders: Medicines that keep phosphorus in the foods you eat from getting into your blood.

Phosphorus: A mineral in your blood that is important to your bones, muscles, and heart. Healthy kidneys keep the right amount of phosphorus in your blood. With kidney disease and kidney failure, phosphorus can build up in the blood.

Vitamins: Vitamins are nutrients that your body needs to work properly.

The **National Kidney Foundation** is the leading organization in the U.S. dedicated to the awareness, prevention, and treatment of kidney disease for hundreds of thousands of healthcare professionals, millions of patients and their families, and tens of millions of Americans at risk.

Help fight kidney disease.

Learn more at **www.kidney.org**



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Awareness. Prevention. Treatment.

