



PATIENT EDUCATION
Familial Hypercholesterolemia

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What Is Familial Hypercholesterolemia?

Familial hypercholesterolemia (FH) is an inherited cardiovascular condition. It affects the way the body processes cholesterol. As a result, people with FH have high levels of LDL cholesterol. LDL stands for low-density lipoproteins. It is sometimes called the “bad” cholesterol because high levels of LDL can cause your arteries to get hard and narrow. This is called atherosclerosis. This greatly increases the risk of heart disease and early heart attack or stroke. See Figure 1.

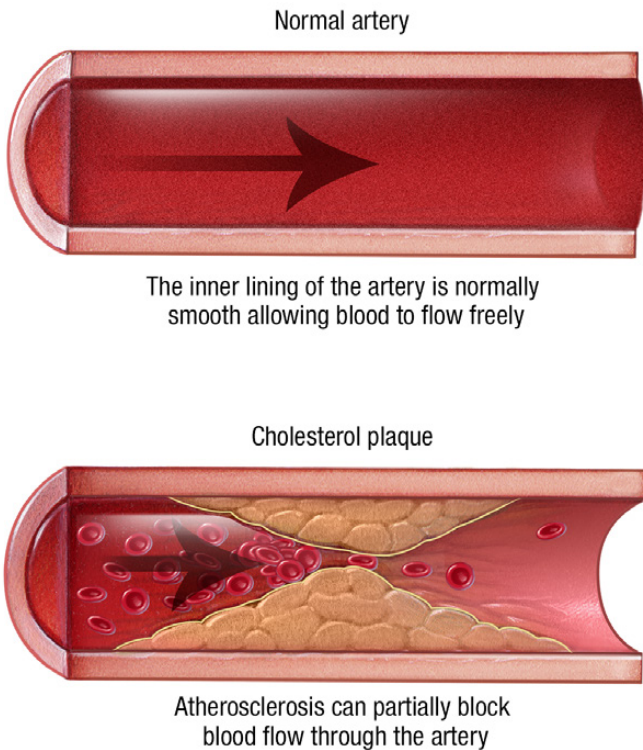


Figure 1. Atherosclerosis

About 1 in 250 people have this condition. But most people do not know they have it. FH affects both men and women. Because it is inherited, the condition is present from birth.

Familial hypercholesterolemia is life-threatening if it is not treated. Of all inherited diseases, it is the most common cause of early disease and early death in the United States. However, early diagnosis and treatment can lower the risks that come with the condition.

What Causes Familial Hypercholesterolemia?

A gene mutation causes FH. A gene mutation is a change in a gene. It can be passed down from one or both parents.

If only one parent has the changed gene, there is a 50/50 chance of it being passed to a child. The most common form of the condition is called heterozygous FH (HeFH). The parents, siblings and children of people with this form of the condition also have a 50/50 chance to have the changed gene. This gene is called a dominant gene. This means that if a person inherits even one of these genes from a parent, they will develop high cholesterol.

People with HeFH have an increased risk of coronary artery disease and stroke if they do not get treatment. Early diagnosis and treatment can greatly lower this risk. However, many people do not get a diagnosis until they have chest pain or a heart attack.

If both parents have the gene defect, there is a chance to pass down two gene mutations. This form of the condition is far less common. It is called homozygous FH (HoFH). People with two gene mutations have extremely high cholesterol levels. They usually develop coronary artery disease very early in life if they are not diagnosed and treated.

How Is Familial Hypercholesterolemia Diagnosed?

A diagnosis of FH can be made with a genetic test. See “Genetic testing.” A diagnosis also can be made based on your cholesterol levels and your family history of early heart attacks and strokes.

Do you have:

- High LDL cholesterol levels from an early age? High LDL levels are above 190 mg/dL in adults and above 160 mg/dL in children.
- A family history of early heart attacks and strokes? Early for women is before the age of 65. Early for men is before the age of 55.

If you have high cholesterol levels from an early age and a family history of early heart attacks and strokes, talk to your health care provider about familial hypercholesterolemia.

Other signs of familial hypercholesterolemia

Some people with FH may develop fatty deposits on the body. These deposits are called xanthomas. A common place for these to occur is on tendons. At first, it may look like a thickening of the tendon. Later, the area may turn into a yellowish deposit. This most often shows up on the Achilles tendon. The Achilles tendon connects the muscles in the back of the calf to the heel bone. But these fatty deposits also can appear on the hands, feet, elbows and knees.

Some people develop cholesterol deposits around the eyes. These deposits are called xanthelasma. See Figure 2.

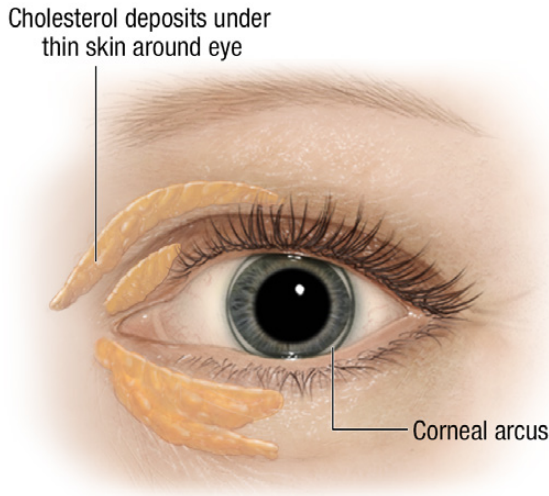


Figure 2. Xanthelasma

Corneal arcus may be a sign of FH if it occurs in people younger than 45 years. Corneal arcus is a grey or white arc near the colored part of the eye. See Figure 2. The arc may be visible above and below the outer part of the cornea. The arc may become a complete ring around the colored part of the eye.

If treated with cholesterol-lowering medications, any of these signs of FH may go away.

Note: Having signs of FH on your body increases your chance of having the condition. But many people with the condition have no physical signs at all. If you have high cholesterol levels and a family history of heart attacks and strokes, talk to your health care provider to learn more about whether you may have familial hypercholesterolemia.

Family screening

If you are diagnosed with FH, consider screening of all first-degree relatives. First-degree relatives are siblings, children and parents. Screening is done with cholesterol testing or genetic testing. This helps to identify other family members who may be at risk and may benefit from early diagnosis and treatment. This is called cascade screening.

In families with FH, cholesterol testing should be considered for children starting at 2 years of age. Early diagnosis and treatment can help people live longer, healthier lives.

Genetic testing

If you have FH, you have up to a 70% chance that genetic testing will find the gene mutation that caused it.

If you have been diagnosed with FH but genetic testing does not find a gene mutation linked to it, this fact does not change your diagnosis. You may have a mutation that is not included in the test. Or you may have a genetic change that has not yet been linked to the condition.

Should I have genetic testing?

It is up to you to decide whether genetic testing is right for you. Talk to your health care provider about any questions you have.

Genetic testing may:

- Confirm your diagnosis of the condition. This may allow your care team to rule out other medical conditions.
- Help your care team begin treatment right away to lower your cholesterol.
- Give you information about your gene mutation. Certain gene mutations are more severe than others and may require different treatment.
- Give you information that could allow your family members to be tested. If you have a gene mutation that is confirmed by genetic testing, your children, siblings and parents can be tested for the same mutation at a lower cost. This can make it easier to get immediate treatment if they test positive.

If a family member tests negative for a confirmed mutation, in most cases the individual has no greater risk for heart attack and stroke than the general population.

Some insurance providers do not cover genetic testing. Talk to a genetic counselor about prior authorization, which can help you understand exactly what your insurance provider may cover. Talk to your insurance provider if you have questions about coverage.

For some people, learning information from genetic testing can be stressful and may cause anxiety. Talk to your care team about whether genetic testing is right for you or your family.

How Is Familial Hypercholesterolemia Treated?

There are effective therapies to treat this condition. Medications and changes in your daily living can greatly lower your risk of heart attack and stroke.

Managing any risk factors that you have, such as smoking, diabetes or high blood pressure, will lower your risk of heart attack and stroke.

Treatment can lower your risk for heart attack

When not treated:

- 1 out of 2 men with FH will have a heart attack by age 50.
- 1 out of 3 women with FH will have a heart attack by age 60.

Treatment can lower the risk of a heart attack so that it is no greater than the average risk for adults in the United States.

Changes in daily living can lower risk factors and treat familial hypercholesterolemia

Changes you can make in your daily life are important. These include exercise and eating a healthy, low-fat diet. A Mediterranean-style diet, which is high in monounsaturated fats and includes lots of fruits and vegetables, has been shown to lower LDL levels. Talk to your care team about a plan to do the following:

- **Quit smoking if you are a smoker.** Smoking or using tobacco of any kind is one of the biggest risk factors for heart disease. Chemicals in tobacco can damage your heart and blood vessels. That can lead to plaque buildup that narrows the arteries. This is called atherosclerosis.
- **Manage your diabetes if this is a risk factor for you.** Many of the healthy changes that can treat FH also are helpful if you have diabetes.
- **Lower your blood pressure if you have high blood pressure.** Talk to your care team about how to lower your blood pressure if this is a risk factor for you.
- **Lower the amount of saturated fat in your diet** to less than 7% of your daily calories and the amount of total fat to less than 30% of your daily calories. Lower the cholesterol in your diet to less than 200 mg per day.
- **Consume 10 to 20 grams of soluble fiber a day.** Good sources include oats, peas, beans, apples, citrus fruits and carrots.

- **Increase your physical activity:**
 - Make a commitment to move every day. Like other muscles, your heart becomes stronger with regular physical activity.
 - Work toward getting at least 150 minutes of moderate aerobic activity or 75 minutes of vigorous activity a week. Moderate aerobic exercise includes activities such as brisk walking, swimming and mowing the lawn. Vigorous aerobic exercise includes activities such as running and aerobic dancing. You also can combine moderate and vigorous activity.
 - Try to do at least 30 minutes of moderate physical activity every day.
 - Work to spread out physical activities during the week. Even small amounts of activity can help you. They add up during the day to provide health benefits. For example, if you can't fit in one 30-minute walk during the day, try a few five-minute walks instead.
 - Try interval training. See "Interval training may be one of the best workouts for your heart."

Interval training may be one of the best workouts for your heart

Any form of aerobic exercise, for example, when you walk, run, bike, or swim, can improve your cardiovascular fitness. But interval training is especially effective. Interval training uses short bursts of high-intensity activity that alternate with less intense activity.

Interval training challenges your heart. It puts your heart into a maximum heart rate zone for short bursts of time. That heart rate is the upper limit of what your cardiovascular system can handle during physical activity. When it feels like you're working very hard, you are getting close to this heart rate zone.

During interval training, you work very hard for short periods of time. Then you do a low-intensity interval for a short time. Between the two intervals, your heart rate moves back into a lower heart rate zone. This allows your heart rate to recover.

Bringing your heart rate back up after a short rest challenges your heart muscle to operate more efficiently.

How does interval training work?

Here's a sample 40-minute exercise session that includes interval training:

1. Walk slowly to warm up. Gradually increase to a moderate pace for 5 minutes.
2. Increase your speed so that you're walking briskly.
3. After 5 minutes of brisk walking, increase your speed so that you are jogging for 30 seconds to 2 minutes. **Do not worry if you cannot build up to a jog. It also is good for your heart to alternate moderate and vigorous walking.**
4. Slow down and walk at a moderate pace for 1 to 3 minutes.
5. Repeat steps 2, 3 and 4.
6. After 35 minutes, walk at a slower pace for 5 minutes to cool down.

Think about hiring a personal trainer or other expert to help you plan the intensity and time of your intervals. The trainer can base a plan on your target heart rate. That rate is based on the ability of your heart and lungs to deliver peak oxygen intake to your muscles, as well as on other factors.

Some activities encourage interval training. They are good for people who are just starting an exercise program. Take the stairs when you can. Look into activities like pickleball and Zumba that may be available in your community.

Talk to your health care provider before you start a new exercise program.

Medications to treat familial hypercholesterolemia

Medications to help lower your LDL cholesterol levels are an important part of treatment.

The choice of medication or combination of medications that may be right for you depends on various factors. These include your personal risk factors, your age, your health and possible medication side effects. Common medications include:

- **Statins.** Statins block a substance your liver needs to make cholesterol. This causes your liver to remove cholesterol from your blood. Statins can also help your body reabsorb cholesterol from built-up deposits on your artery walls. That has the potential to reverse coronary artery disease.

Statins are approved for use in children 10 years and older.

Women who are planning to get pregnant should stop taking statins. For women who breastfeed, do not restart taking statins until you have finished breastfeeding. If you think you may be pregnant, do not start taking statins until you have a pregnancy test.

- **Bile-acid-binding resins.** Your liver uses cholesterol to make bile acids, a substance for digestion. The medications lower cholesterol indirectly by binding to bile acids. Medications are available that bind to bile acids. That prompts your liver to use excess cholesterol to make more bile acids, which in turn can lower the level of cholesterol in your blood.
- **Cholesterol absorption inhibitors.** Your small intestine absorbs the cholesterol from your diet and releases it into your bloodstream. Cholesterol absorption inhibitors help reduce blood cholesterol by limiting the absorption of dietary cholesterol. This can lower your cholesterol.

- **Injectable medications.** A newer class of drugs, known as PCSK9 inhibitors, can help the liver absorb more LDL cholesterol. This lowers the amount of cholesterol circulating in your blood. These injectable medications have been approved for people who have FH or who have a history of coronary disease who have intolerance to statins or other cholesterol medications. See “Injectable medications to treat familial hypercholesterolemia.”

Injectable medications to treat familial hypercholesterolemia

New medications to treat FH include PCSK9 inhibitors. Injectable medications that inhibit the actions of PCSK9 can help dramatically lower LDL cholesterol levels.

The liver makes a protein called PCSK9. Many people with FH have increased levels of this protein. It attaches to LDL receptors in the liver, telling the liver to get rid of them. Without enough of these receptors, LDL cholesterol levels can get very high.

For individuals with FH, this is an important breakthrough. Early and regular treatment can significantly lower the risk of heart attack and stroke.

Injectable medications to treat FH are highly regulated. It may take weeks to months for you to receive them. When you start taking injectable PCSK9 inhibitors, your care team will give you detailed instructions that you must follow exactly.

Do not stop or change how often you take injectable medication to treat FH. If there are any changes not approved by your health care provider, it is likely that your insurance company will not approve refills. **It can take up to a year to find the ideal combination of medications for you.**

Follow-up blood draws

You will have follow-up blood draws. If you don't get the follow-up blood draws as scheduled, it is likely that your insurance company will not approve refills.

Other medications you take

If any of your other medications are stopped or changed, tell the health care provider who manages your injectable medications.

Continue to refill your prescriptions as you are told to do. If you stop or change your medications, your cholesterol levels may go up. If this happens, your insurance company may stop payment for injectable medications.

Side effects of medications to treat familial hypercholesterolemia

Talk to your health care provider about possible side effects of medications to treat FH.

Common side effects of oral medications to lower LDL cholesterol include muscle pains, stomach pain, constipation, nausea and diarrhea.

Side effects of injectable medications may include itching, swelling, pain or bruising at the injection site, rash, hives, and swelling of nasal passages.

If you decide to take medication to lower your cholesterol, your care team may recommend liver function tests. These are done to monitor the effect of the medication on your liver.

Living With Familial Hypercholesterolemia

Familial hypercholesterolemia is a life-threatening condition if it is not treated. Without treatment, individuals are at a 20 times higher risk of a heart attack.

The good news is that with the right changes in daily living and with treatment, the risk of a heart attack or stroke can be greatly reduced. If FH is diagnosed at a young age, treatment can lower the risk of a heart attack. It can be lowered so that it is no greater than the average risk for adults in the United States.

Use what you have read in this resource to help you understand this condition and how it is treated. If you have any questions, talk with your health care provider.

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Mrs. Lips, a resident of San Antonio, Texas, was a loyal Mayo Clinic patient of more than 40 years and a self-made business leader who significantly expanded her family's activities in oil, gas and ranching. Upon her death in 1995, Mrs. Lips paid the ultimate compliment by leaving her entire estate to Mayo Clinic. By naming the Barbara Woodward Lips Patient Education Center, Mayo honors her generosity, her love of learning, her belief in patient empowerment and her dedication to high-quality care.

This material is for your education and information only. This content does not replace medical advice, diagnosis or treatment. New medical research may change this information. If you have questions about a medical condition, always talk with your health care provider.

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