CONDITION

Hemoglobin C disease

Hemoglobin C disease is an inherited blood condition that usually causes mild, lifelong breakdown of red blood cells.

WHAT IT IS
Inherited condition causing usually mild red blood cell breakdown

BODY SYSTEM
Blood and circulation

MAIN SYMPTOMS
No symptoms, mild anemia, jaundice, enlarged spleen

WHAT CAUSES IT
Inherited changes in both HBB gene copies

HOW IT IS DIAGNOSED
Hemoglobin electrophoresis or HPLC, sometimes genetic testing

MAIN TREATMENT
Monitoring and treatment of anemia or complications

CAN IT BE CURED?
No - inherited gene changes remain lifelong

IS IT AN EMERGENCY?
Sometimes - fainting or breathing trouble from severe anemia

LONG-TERM OUTLOOK
Usually mild, with normal daily life and lifespan

Overview

Hemoglobin C disease is an inherited blood condition. Despite its name, it is not an infection or something you can catch from another person.

Hemoglobin is the protein inside red blood cells that carries oxygen. In hemoglobin C disease, most of the hemoglobin is an altered type called hemoglobin C. This can make red blood cells less flexible and shorten their lifespan.

The early breakdown of red blood cells is called hemolysis . If cells break down faster than the body replaces them, mild anemia can develop. Anemia means there are not enough healthy red blood cells to carry oxygen efficiently.

Many people with hemoglobin C disease have no noticeable symptoms. Others have mild

anemia, yellowing of the eyes or skin, or an enlarged spleen. The condition is usually much milder than sickle cell disease and does not normally cause sickle cell pain crises.

Hemoglobin C disease is also called HbCC because a person has two copies of the hemoglobin C gene change. It is different from hemoglobin C trait, in which a person has only one copy.

Symptoms

Symptoms may be absent or mild. The condition is sometimes found through newborn screening or a blood test performed for another reason.

Possible symptoms and signs include:

The spleen is an organ in the upper left abdomen that filters blood and helps the immune system. It may become enlarged because it removes altered red blood cells from circulation.

Symptoms can become more noticeable during an infection or another illness. Rarely, red blood cell production may slow suddenly, causing more severe anemia.

Hemoglobin C disease by itself does not usually cause repeated severe pain, blocked blood vessels, or the organ damage associated with sickle cell disease. If someone with a presumed HbCC diagnosis has these problems, further assessment may be needed to check the exact hemoglobin type or look for another cause.

- Tiredness or reduced stamina from anemia
- Pale skin or paler-than-usual lips
- Yellow eyes or skin, known as jaundice
- An enlarged spleen, which may cause fullness under the left ribs
- Dark urine during periods of increased red blood cell breakdown

Causes and risk factors

Hemoglobin C disease is caused by a change in the HBB gene. This gene provides instructions for making part of hemoglobin.

You inherit one HBB gene copy from each biological parent. Hemoglobin C disease develops when both copies carry the hemoglobin C change. This inheritance pattern is called autosomal recessive .

When both parents have hemoglobin C trait, each pregnancy has:

These chances start again with every pregnancy. They do not mean that one child out of every

four in a family must have the condition.

Hemoglobin C trait usually causes no health problems. However, a person with the trait can pass the gene change to a child.

Different conditions can occur if hemoglobin C is inherited with another hemoglobin change. For example, inheriting hemoglobin C from one parent and hemoglobin S from the other causes hemoglobin SC disease , a form of sickle cell disease. Inheriting hemoglobin C with a beta-thalassemia change causes hemoglobin C-beta-thalassemia. These conditions can behave differently from HbCC.

Hemoglobin C is more common in people whose families come from West Africa, but it can occur in any ethnic or racial group. Family origin can guide testing, but it cannot confirm or rule out the condition.

- A 1 in 4 chance of hemoglobin C disease
- A 1 in 2 chance of hemoglobin C trait
- A 1 in 4 chance of inheriting neither hemoglobin C change

Diagnosis

In many places, hemoglobin C disease is first detected through newborn blood-spot screening. The screening result must be confirmed because some hemoglobin patterns can represent more than one condition.

Tests used to confirm the diagnosis include hemoglobin electrophoresis , high-performance liquid chromatography , often shortened to HPLC, or similar methods that measure different types of hemoglobin. Genetic testing may be used if the result is unclear or if another inherited hemoglobin condition is suspected.

Other blood tests help assess its effects:

Under a microscope, some red blood cells may look like targets, with a darker centre and outer ring. Hemoglobin C crystals may also be seen. These findings can support the diagnosis, but hemoglobin analysis is needed to identify the condition accurately.

Iron deficiency can also cause anemia and may occur alongside hemoglobin C disease. Iron levels should be checked rather than assuming that anemia is caused by low iron.

Testing biological parents can clarify how the condition was inherited. A genetic counsellor can help explain test results and what they may mean for other family members.

- A complete blood count measures hemoglobin and red blood cells

- A reticulocyte count measures young red blood cells
- Bilirubin testing looks for a substance released during cell breakdown
- A blood film examines the shape and appearance of blood cells

Treatment and management

Most people with hemoglobin C disease do not need condition-specific treatment. Management focuses on monitoring anemia and addressing complications if they occur.

Routine follow-up may include blood counts and a review of symptoms. How often this is needed is based on age, symptoms, pregnancy, other medical conditions, and previous test results.

Folic acid helps the body make red blood cells. A clinician may consider a supplement when red blood cell production is increased, but it is not automatically needed by everyone. Iron should not be taken specifically for this condition unless testing confirms iron deficiency. Unneeded iron can build up in the body.

Blood transfusions are rarely required for HbCC alone. They may be considered if severe anemia develops because of an infection, bleeding, surgery, pregnancy-related problems, or another blood condition.

An enlarged spleen usually needs observation rather than treatment. Removal of the spleen is uncommon and is generally reserved for serious, persistent complications. People who have had their spleen removed need a specific vaccination and infection-prevention plan.

Gallstones may require treatment if they repeatedly cause pain, infection, or blockage. Treatment is based on symptoms rather than their presence alone.

Routine vaccinations, balanced nutrition, regular activity, and general preventive healthcare remain important. There is usually no need to restrict exercise solely because of hemoglobin C disease, although activity may need to be adjusted if anemia is causing symptoms.

Complications

Complications are uncommon, but ongoing red blood cell breakdown can sometimes cause problems.

Bilirubin released from broken-down red blood cells can collect in the gallbladder and form pigment gallstones . These may cause pain in the upper right abdomen, especially after eating, as well as nausea or jaundice.

The spleen may remain enlarged. A very large spleen can trap blood cells, lower blood counts, or cause discomfort. Injury to an enlarged spleen can also cause internal bleeding, although this is rare.

Some infections, particularly parvovirus B19, can temporarily stop the bone marrow from making enough red blood cells. This is called an aplastic crisis . It can cause a rapid increase in tiredness, paleness, breathlessness, or weakness and needs prompt medical assessment.

Chronic mild anemia and occasional jaundice may continue throughout life. Severe organ damage is not typical of HbCC. Problems such as repeated pain crises, stroke, or severe lung disease are more characteristic of sickle cell disease, including hemoglobin SC disease, rather than hemoglobin C disease.

Prevention

Hemoglobin C disease cannot be prevented through diet, exercise, vaccination, or lifestyle changes because it is inherited.

Carrier screening can show whether you or your partner carries hemoglobin C or another hemoglobin change. This may be useful before or during pregnancy, particularly if there is a known family history.

If both biological parents carry relevant gene changes, genetic counselling can explain the possible outcomes for a pregnancy. Prenatal testing and testing of embryos created through in vitro fertilisation may be available. These are personal options rather than required steps.

Newborn screening does not prevent the condition, but it can identify it early and distinguish it from conditions that need closer follow-up.

Living with it and what to expect

Hemoglobin C disease is lifelong because the inherited gene change remains present. For most people, it stays mild rather than steadily getting worse.

A slightly low hemoglobin level or an enlarged spleen may remain stable for years. Jaundice can come and go, especially during illness or increased red blood cell breakdown. Gallstones become more likely when hemolysis continues over a long period, but not everyone develops them.

Most children grow and develop normally. Adults can usually work, exercise, travel, and take part in everyday activities without major restrictions. Life expectancy is generally normal when

the diagnosis is HbCC without another significant health condition.

Pregnancy is often well tolerated, but anemia should be monitored as part of prenatal care. It is important that the maternity team knows the exact hemoglobin diagnosis. Testing the other biological parent may help assess whether a baby could inherit HbCC, hemoglobin SC disease, or another hemoglobin condition.

Keep a record of your confirmed hemoglobin type. "Hemoglobin C" can refer to trait, HbCC, hemoglobin SC disease, or hemoglobin C-beta-thalassemia, and these do not have the same health effects.

Routine follow-up is appropriate for stable mild anemia, occasional jaundice, or a known enlarged spleen without new symptoms. New or worsening symptoms deserve review rather than being assumed to be part of the condition.

When to get medical help

Arrange a routine appointment if you develop increasing tiredness, more frequent jaundice, abdominal fullness, or reduced exercise tolerance. Also seek advice before pregnancy or if you are unsure whether your diagnosis is HbCC, hemoglobin C trait, or hemoglobin SC disease.

Get prompt medical help for:

Seek emergency care for fainting, severe breathing difficulty, confusion, chest pain, or extreme weakness. These can be signs of severe anemia or another serious problem.

Severe pain in the upper left abdomen after an injury, especially with left shoulder pain, dizziness, or fainting, may indicate bleeding from the spleen and requires emergency care.

- A sudden increase in paleness, weakness, or breathlessness
- New dark urine or rapidly worsening jaundice
- Persistent pain under the left ribs or in the upper right abdomen
- Fever with abdominal pain, vomiting, or jaundice
- Symptoms of anemia during an infection

Common questions

Is hemoglobin C disease the same as sickle cell disease?

No. HbCC usually causes mild red blood cell breakdown without sickle cell pain crises. Hemoglobin SC disease is a type of sickle cell disease caused by inheriting one hemoglobin C

gene and one hemoglobin S gene.

What is the difference between hemoglobin C trait and hemoglobin C disease?

Hemoglobin C trait means one HBB gene copy carries the hemoglobin C change. It usually causes no symptoms. Hemoglobin C disease means both copies carry the change and may cause mild anemia, jaundice, or an enlarged spleen.

Can hemoglobin C disease turn into cancer or sickle cell disease?

No. It does not turn into cancer or change into sickle cell disease. The inherited hemoglobin type stays the same throughout life.

Can I donate blood if I have hemoglobin C disease?

Blood donation rules differ between services. Anemia may prevent donation even when you otherwise feel well. The donation service will assess your hemoglobin level and its own eligibility requirements.

Do I need to avoid certain foods or activities?

There is no special HbCC diet, and most people do not need activity restrictions. Do not take iron solely for anemia unless iron deficiency has been confirmed. If your spleen is enlarged, ask about activities that could involve a hard blow to the abdomen.

Will my children have hemoglobin C disease?

That depends on which hemoglobin genes the other biological parent carries. A child can inherit hemoglobin C trait, HbCC, hemoglobin SC disease, or another hemoglobin condition. Carrier testing and genetic counselling can clarify the possible outcomes.

Sources

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