TEST

Hemoglobin electrophoresis

A blood test that identifies and measures different types of hemoglobin

WHAT IT MEASURES
Types and proportions of hemoglobin in red blood cells

SAMPLE
Blood

FASTING NEEDED?
No

HOW LONG IT TAKES
About 5 to 10 minutes

RESULTS IN
Usually several days; timing varies by laboratory

USED FOR
Screening and diagnosis; sometimes monitoring

MAIN LIMITATION
Some variants overlap, and alpha thalassemia may appear normal

Overview

Hemoglobin electrophoresis is a blood test that looks for different types of hemoglobin. Hemoglobin is the protein inside red blood cells that carries oxygen around your body.

The test uses an electrical field to separate hemoglobin types according to their physical properties. Many laboratories now use related methods, such as capillary electrophoresis or high-performance liquid chromatography. Your report may still describe the overall investigation as hemoglobin electrophoresis.

Most adults mainly have hemoglobin A. Smaller amounts of hemoglobin A2 and hemoglobin F are also expected. Babies naturally have much more hemoglobin F, sometimes called fetal hemoglobin.

Inherited changes in hemoglobin can produce types such as hemoglobin S, C, E, or D. These changes are called hemoglobin variants. The test can also support an assessment for thalassemia, a group of inherited conditions that reduce hemoglobin production.

An electrophoresis result must be interpreted with your blood count, medical history, age, family background, and any recent transfusions. The test alone does not always identify the

exact genetic change.

Why the test is ordered

Hemoglobin electrophoresis may be ordered when a blood count shows anemia or unusually small red blood cells and the cause remains unclear. Anemia means the blood has less oxygen-carrying capacity than expected.

The test may help investigate:

It can also be used for carrier screening. A carrier has one altered gene but may have no symptoms. Carrier information can help you understand the chance of passing a hemoglobin condition to a child.

Electrophoresis may occasionally be repeated to assess the effects of transfusion or treatment. Inherited hemoglobin types themselves do not usually change over time.

- Possible sickle cell disease or sickle cell trait
- Possible beta thalassemia or another hemoglobin variant
- An abnormal newborn screening result
- Unexplained anemia, jaundice, or red blood cell breakdown
- A known family history of a hemoglobin condition
- A previously identified variant that needs clarification

Who should have the test

You may be offered this test if your symptoms, blood count, newborn screening result, or family history suggests a possible hemoglobin condition.

Testing may also be discussed before or during pregnancy. If one biological parent carries a significant hemoglobin variant, testing the other parent can help estimate the chance that a baby could inherit a condition.

Newborn screening programs often test for important hemoglobin variants, but the disorders included and the methods used differ by location. A screening result is not always a final diagnosis. Further testing may be needed.

Ancestry can help guide testing because some variants are more common in people whose families came from certain regions. However, ancestry alone cannot confirm or exclude a hemoglobin variant, and people may not know their complete family background.

How to prepare

You do not normally need to fast. You can usually eat, drink water, and take your regular medicines.

Tell the healthcare professional ordering the test if you have recently had:

Do not stop prescribed medicines unless you have been specifically told to do so.

A transfusion can make the result difficult to interpret because the sample may contain both your red blood cells and the donor's cells. Depending on why the test is needed, it may be done now or postponed.

- A blood transfusion
- A stem cell or bone marrow transplant
- Iron deficiency or treatment with iron
- Treatment intended to change hemoglobin production, such as hydroxyurea

What happens during the test

A healthcare professional takes a small blood sample, usually from a vein in your arm. A band may be placed around your upper arm, and the skin is cleaned before the needle is inserted.

The blood draw usually takes a few minutes. The sample is sent to a laboratory, where the hemoglobin types are separated and measured.

Young babies may have blood collected from a heel or another suitable site. Newborn screening may use a dried blood spot rather than a tube of blood.

Understanding your results

Your report may list hemoglobin types as percentages or proportions. It may also show a pattern suggesting a particular variant.

Common labels include:

A detected variant does not automatically mean you have an illness. The amount and combination of hemoglobin types help distinguish a carrier pattern from a condition involving two altered genes. Recent transfusion, age, treatment, and other test results can change that interpretation.

A raised hemoglobin A2 level can support beta thalassemia trait, but it is not interpreted by

itself. Alpha thalassemia trait often produces a normal adult electrophoresis result.

Reference ranges differ according to the laboratory and testing method. Interpretation may also vary with age, sex, pregnancy status, medicines, transfusion history, and clinical context. Use the ranges printed on your own report rather than a general range found online.

- Hemoglobin A: the main adult hemoglobin
- Hemoglobin A2: a minor adult hemoglobin that can help assess beta thalassemia
- Hemoglobin F: the main hemoglobin before birth, normally higher in babies
- Hemoglobin S, C, E, or D: inherited hemoglobin variants

What affects the results

Several factors can change the hemoglobin pattern without a laboratory error.

Recent blood transfusion is one of the most important. Donor red blood cells may add normal hemoglobin or a donor variant to your sample. They can also dilute a variant that is present in your own cells.

Age strongly affects the result. Hemoglobin F is expected to be high in newborns and falls as the baby begins producing adult hemoglobin. Adult reference ranges should not be applied to infants.

Iron deficiency may lower hemoglobin A2. This can make beta thalassemia trait less obvious, especially when the result is close to the laboratory's decision point.

Pregnancy can affect blood counts and the reference information used to interpret some hemoglobin fractions. The result should be read using pregnancy-appropriate context.

Medicines and treatment can alter the proportions. Hydroxyurea, for example, can increase hemoglobin F. Transfusion therapy is also expected to change the measured pattern.

Stem cell or bone marrow transplantation may cause the detected hemoglobin to reflect the donor's blood-forming cells rather than your original pattern.

Eating, drinking coffee, and the time of day do not usually change which hemoglobin types are present. Dehydration or recent exercise may affect some blood count measurements, but they do not normally create an inherited hemoglobin variant.

Accuracy and limitations

Hemoglobin electrophoresis is good at detecting many common hemoglobin variants, but it

does not find every inherited blood condition.

Some different variants move to the same position during electrophoresis. This can make one variant look like another, producing a suspected identification that later proves to be different. A laboratory may use a second method to separate them more clearly.

The test can also miss a condition. Alpha thalassemia trait often has a normal electrophoresis pattern. A low-level variant may be hidden by a recent transfusion, and iron deficiency may make beta thalassemia trait harder to recognize.

Results are usually considered alongside a complete blood count, blood film, iron studies, and family information. A second separation method or DNA testing may be better when the pattern is unclear, alpha thalassemia is suspected, or an exact genetic diagnosis is needed.

Newborn screening is designed to identify babies who need follow-up, but screening can produce uncertain patterns. Confirmatory testing helps establish whether a variant is present and what it means.

Risks and complications

A blood draw may cause brief discomfort, a small bruise, or light-headedness. Serious complications from routine blood collection are uncommon.

What happens next

A normal result may end the investigation if your other blood tests are also reassuring. If anemia or small red blood cells remain unexplained, other tests may still be needed because electrophoresis does not detect every cause.

If a carrier pattern is found, routine follow-up may include an explanation of inheritance, testing for a biological partner, or genetic counselling. A carrier result usually does not require emergency treatment.

An unclear or abnormal pattern may lead to repeat electrophoresis, testing by a different laboratory method, iron studies, or genetic testing. Newborn screening results usually need timely confirmatory follow-up.

The test result itself is rarely an emergency. Seek urgent medical care for severe trouble breathing, chest pain, fainting, new weakness on one side, difficulty speaking, or another sudden serious symptom. These symptoms need assessment regardless of an electrophoresis result.

Common questions

Can I drink coffee before hemoglobin electrophoresis?

Yes. Coffee does not normally affect the hemoglobin pattern. Follow different instructions if other fasting blood tests are being taken at the same appointment.

Does the time of day matter?

No. Hemoglobin electrophoresis can usually be performed at any time of day.

Can I exercise beforehand?

Normal activity is fine. Very strenuous exercise and dehydration may affect some accompanying blood count results, so resting and drinking water can be helpful.

Should I stop my medicines?

No, unless the healthcare professional responsible for your prescription tells you to stop. Provide a current medicine list because treatments such as hydroxyurea can affect the proportions reported.

Can I have the test after a blood transfusion?

Yes, but donor red blood cells may make the result misleading. Tell the laboratory when the transfusion occurred so the result can be interpreted or testing can be rescheduled if appropriate.

Will this test show whether I have alpha thalassemia?

Not reliably. Adult electrophoresis is often normal in alpha thalassemia trait. Blood counts, iron studies, family information, and sometimes DNA testing are more useful.

Sources

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