TEST

Osmotic fragility test

A blood test that checks how easily red blood cells burst in dilute salt solutions.

WHAT IT MEASURES
Red blood cells' resistance to bursting in dilute salt solutions

SAMPLE
Blood

FASTING NEEDED?
No

HOW LONG IT TAKES
About 5 to 10 minutes

RESULTS IN
Usually several days; timing differs by laboratory

USED FOR
Supporting diagnosis of red blood cell membrane disorders

MAIN LIMITATION
Abnormal results are not specific to one disorder

Overview

The osmotic fragility test checks how easily your red blood cells burst when placed in increasingly dilute salt solutions. "Osmotic" refers to water moving across a cell membrane. "Fragility" means how easily the cell breaks under this stress.

Healthy red blood cells are flexible, flattened discs. This shape gives them room to swell as water enters. Cells that are more rounded, such as spherocytes, have less room to expand and may burst sooner.

Spherocytes can occur in hereditary spherocytosis, an inherited condition affecting proteins that support the red blood cell membrane. They can also occur in acquired conditions, including some immune-related forms of red blood cell destruction. An abnormal osmotic fragility result therefore cannot identify the cause by itself.

The test is now often used with, or replaced by, newer tests such as the eosin-5-maleimide binding test, usually called the EMA test. Your laboratory's available methods and your clinical circumstances help determine which test is used.

Why the test is ordered

The test may be ordered when other findings suggest that red blood cells are being destroyed earlier than normal. This process is called haemolysis.

Possible reasons include:

It is usually part of a wider investigation. Other tests may include a full blood count, reticulocyte count, bilirubin, haptoglobin, lactate dehydrogenase, blood film and a direct antiglobulin test. These help show whether haemolysis is occurring and whether an immune reaction may be involved.

- Investigating suspected hereditary spherocytosis
- Clarifying an abnormal blood film showing round red blood cells
- Supporting the investigation of unexplained anaemia
- Assessing jaundice linked to red blood cell breakdown
- Investigating similar blood problems in close relatives

Who should have the test

You may be offered this test if your history, examination or other blood results suggest an inherited red blood cell membrane condition. Clues can include anaemia, repeated jaundice, an enlarged spleen, gallstones at a young age or relatives with hereditary spherocytosis.

The test is not generally used to screen people without relevant symptoms, family history or abnormal blood findings. It is also not enough to diagnose hereditary spherocytosis on its own.

Newer membrane tests may be preferred because standard osmotic fragility testing can miss mild cases and can be abnormal in conditions other than hereditary spherocytosis.

How to prepare

You can usually eat and drink normally. Fasting is not required, so coffee is generally allowed unless you are having other fasting blood tests at the same appointment.

Tell the healthcare professional arranging the test if you have recently had a blood transfusion. Transfused red blood cells can remain in your circulation and may make the result difficult to interpret.

Also provide an up-to-date list of medicines and supplements. Do not stop prescribed

medicines unless the professional responsible for your care has told you to do so.

Follow any instructions from the laboratory. Specimen handling requirements can differ because some laboratories perform the test on fresh blood, while others also test blood after controlled incubation.

What happens during the test

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

In the laboratory, portions of your blood are added to salt solutions with different concentrations. Water enters red blood cells more readily in the more dilute solutions. The laboratory measures how many cells burst at each concentration and may display the findings as a curve.

Some laboratories perform an incubated osmotic fragility test. The blood is kept under controlled conditions before testing, which can make certain membrane abnormalities easier to detect.

Understanding your results

Results may be reported as increased, normal or decreased osmotic fragility. Some laboratories instead report the salt concentrations at which haemolysis begins and becomes complete, or show a fragility curve.

Increased osmotic fragility means the red blood cells burst in less dilute solutions than expected. This can occur when many cells are spherical and have limited capacity to swell. Hereditary spherocytosis is one possible explanation, but immune haemolytic anaemia and other conditions can produce a similar result.

Decreased osmotic fragility means the cells tolerate more dilute solutions before bursting. This may occur when red blood cells have extra surface area relative to their volume, as can happen with thalassaemia, iron deficiency and some conditions that produce target-shaped cells.

A normal result does not always rule out hereditary spherocytosis, particularly when the condition is mild or only a small proportion of cells is affected.

Reference ranges and interpretation vary by laboratory and testing method. Age, sex,

pregnancy status, medicines, recent treatment and the wider clinical context may also matter. Your result should be considered alongside your blood count, blood film and other haemolysis tests.

What affects the results

Several factors can change the result without there being a laboratory error.

Routine eating, coffee, normal daily activity and the time of day usually have little direct effect. Medicines are not a common source of direct interference, but medicines that affect blood cell production or cause haemolysis can change the clinical picture.

- Recent blood transfusion: Donor cells may be less fragile than your own cells, masking an abnormal population or creating a mixed result
- Increased young red blood cells: Reticulocytes, which are newly produced red blood cells, are often more resistant to osmotic stress and may hide increased fragility
- Iron deficiency or thalassaemia: These can decrease fragility and may partly mask hereditary spherocytosis if both conditions are present
- Sample age and storage: Delayed testing, temperature changes or incorrect handling can alter red blood cell membranes
- Blood collection problems: A damaged or partly clotted sample may not be suitable for testing
- Recent spleen removal: Splenectomy changes which red blood cell shapes remain in circulation and can affect interpretation
- Acquired spherocytes: Burns and immune-related red blood cell destruction can increase fragility without an inherited membrane disorder

Accuracy and limitations

The osmotic fragility test can support a diagnosis, but it is neither a perfect rule-in nor a perfect rule-out test.

It may miss mild or well-compensated hereditary spherocytosis, especially when fresh blood alone is tested. Incubating the sample may reveal abnormalities that were not clear initially, although this still does not make the result specific to one condition.

The test can also say "abnormal" when hereditary spherocytosis is not present. Other causes of spherocytes, including immune haemolysis, can increase osmotic fragility.

The EMA binding test uses flow cytometry to assess proteins associated with the red blood cell membrane. It often provides better separation between hereditary spherocytosis and unaffected samples. Osmotic gradient ektacytometry, which measures red blood cell flexibility across changing salt concentrations, may help distinguish different inherited membrane disorders but is not available in every laboratory.

Genetic testing may be helpful in selected unclear or unusual cases. No single test is always best; results are interpreted with your family history, blood film and other laboratory findings.

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 lead to review of other possible explanations for your blood findings. If suspicion remains high, a different membrane test or further haemolysis testing may be considered.

An abnormal result is usually followed by interpretation with your full blood count, reticulocyte count, blood film and tests for immune haemolysis. Family testing or genetic testing may sometimes be discussed.

The test result itself is not an emergency. Arrange routine follow-up with the professional who ordered it so the complete set of findings can be reviewed.

Seek prompt medical advice for worsening jaundice, unusually dark urine, marked weakness or a rapid change in symptoms. Seek emergency care for severe difficulty breathing, chest pain, fainting or confusion, regardless of the test result.

Common questions

Can I drink coffee before the test?

Yes. Coffee is usually allowed because this test does not require fasting. Check your instructions if other blood tests are being collected at the same time.

Does the time of day matter?

Usually not. The osmotic fragility result is not known to have an important daily pattern,

although laboratory collection times may be restricted because the sample needs careful handling.

Can I exercise beforehand?

Normal activity is unlikely to affect the test. Avoiding unusually strenuous exercise may still be sensible if you are unwell or having other blood tests that exercise can influence.

How long after a transfusion should I wait?

There is no single waiting period suitable for everyone. Transfused cells can interfere for weeks to months, so tell the laboratory when the transfusion occurred. The test may be delayed or interpreted with that information.

Does an abnormal result mean I have hereditary spherocytosis?

No. Increased fragility can occur for several reasons, and decreased fragility may point toward other red blood cell changes. Diagnosis requires the wider pattern of results.

Can the test be normal if I have hereditary spherocytosis?

Yes. Standard testing can miss mild cases or results can be masked by young red blood cells, iron deficiency, thalassaemia or a recent transfusion. A different membrane test may be more informative.

Sources

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