Homocysteine

- What is homocysteine?
- Why are homocysteine levels measured?
- What are the possible symptoms and signs of elevated homocysteine levels?
- What are high homocysteine levels?
- What causes elevated homocysteine levels?
- Can elevated homocysteine levels be hereditary?
- How can homocysteine levels be lowered?
- Can lowering homocysteine levels prevent the risk of heart disease, heart attacks, and strokes?
- Who should have their homocysteine levels tested?

What is homocysteine?

Homocysteine is an amino acid. Amino acids are the building blocks of proteins. When proteins break down, elevated levels of amino acids like homocysteine may be found in the bloodstream. Having elevated levels of homocysteine in the blood (hyperhomocysteinemia) is associated with atherosclerosis and blood clots.

It is not possible to get homocysteine from the diet. It must be made from methionine, another amino acid that is found in meat, fish, and dairy products. Vitamins B6 (pyridoxine), B12 and folic acid are needed to make this reaction occur.

Foods containing methionine are transformed into homocysteine in the bloodstream. Homocysteine is converted in the body to cysteine, with vitamin B6 facilitating this reaction. Homocysteine can also be recycled back into methionine using vitamin B12-related enzymes.

Cysteine is an important protein in the body that has many roles. It is involved in the way proteins within cells are folded, maintain their shape, and link to each other. Cysteine is a source of sulfide and is part of the metabolism of different metals in the body including iron, zinc and copper. Cysteine also acts as an antioxidant.

If homocysteine cannot be converted into cysteine or returned to the methionine form, levels of homocysteine in the body increase. Elevated homocysteine levels have been associated with heart attack, stroke, blood clot formation, and perhaps the development of Alzheimer's disease.

Why are homocysteine levels measured?

Elevated levels of homocysteine are associated with heart attack, stroke, and blood clots. If a person develops any of these diseases and does not have
increased risk factors such as smoking, high blood pressure, high cholesterol, or diabetes, then the physician often looks for more unusual causes and risks, including checking homocysteine levels in the blood.

Homocystinuria (meaning elevated homocystine in the urine) is a rare, inherited disease in which affected persons have abnormally high levels of homocysteine due to abnormal metabolism of the amino acid methionine. This condition is associated with a number of different birth defects including abnormalities of the musculoskeletal system. In infants who have a family history of homocystinuria, early screening for elevated levels may help prevent future illnesses related to this metabolic defect. Moreover, infants and young children who have eye problems such as myopia (nearsightedness), changes in the lens of the eye, bone abnormalities, or unusual body shape may be screened for elevated homocysteine levels.

What are the possible symptoms and signs of elevated homocysteine levels?

Elevated homocysteine levels in the body do not cause any symptoms.

- Elevated homocysteine levels affect the interior lining of blood vessels in the body, increasing the risk of atherosclerosis or narrowing of blood vessels. This can result in early heart attack and stroke.
- There is a relationship between the levels of homocysteine in the body and the size of the carotid arteries that supply the brain with blood; the higher homocysteine level, the narrower or more stenosed the carotid artery.
- The risk of deep vein thrombosis and pulmonary embolism may also be linked to elevated homocysteine levels in the body.
- There may be a relationship between elevated homocysteine levels and broken bones, especially in the elderly.
- Alzheimer’s disease and other types of dementia may be more frequently seen in patients with increased homocysteine in the blood.
- In infants who have the genetic condition homocystinuria, the inherited abnormalities affect the body’s metabolism of homocysteine to cysteine. This may result in dislocation of the lens in the eye, sunken chest, Marfan-type appearance (long thin body type), mental retardation, and seizures. Neonatal strokes may also be seen with high homocysteine levels.
- In pregnancy, homocysteine levels tend to decrease. Elevated homocysteine levels may be associated with some fetal abnormalities and with potential blood vessel problems in the placenta, causing abruption. There may also be an association with pre-eclampsia.

What are high homocysteine levels?

Most laboratories report normal homocysteine levels in the blood between 4 and 15 micromoles/liter (µmol/L). Any measurement above 15 is considered high. Optimal homocysteine levels are below 10 to 12.

Hyperhomocysteinemia has been classified into moderate, intermediate, and severe types based on the level of homocysteine as follows:
- Moderate (15 to 30 µmol/L)
- Intermediate (30 to 100 µmol/L)
- Severe (greater than 100 µmol/L)

What causes elevated homocysteine levels?

Homocysteine levels increase in the body when the metabolism to cysteine of methionine to cysteine is impaired. This may be due to dietary deficiencies in vitamin B6, vitamin B12, and folic acid.

While alcoholics tend to be malnourished and lacking in B vitamins, alcohol itself may independently cause homocysteine levels in the blood to rise.

Can elevated homocysteine levels be hereditary?

Genetic abnormalities may affect the body's ability to metabolize homocysteine into cysteine, causing elevation of homocysteine levels in the blood and urine. Screening is often suggested in infants if there is a family history of this disease.

How can homocysteine levels be lowered?

The treatment for homocysteinuria is vitamin supplementation with pyridoxine (vitamin B6), vitamin B12, and folic acid. The effects of vitamin treatment may be monitored by routine, scheduled blood tests. However, evidence to support the value of treating elevated blood levels of homocysteine (except in cases of severely high levels) in the general population is lacking. Therefore, it is not recommended that people be treated with vitamins to lower homocysteine levels as a way to prevent vascular disease.

Some patients do not respond to the vitamin supplementation and are considered pyridoxine-resistant. A diet low in methionine is recommended in addition to the B vitamins.

Can lowering homocysteine levels prevent the risk of heart disease, heart attacks, and strokes?

There is controversy whether lowering homocysteine levels affects the risk of vascular disease like heart attack and stroke. At present there is insufficient evidence to show that lowering these levels has any benefit in terms of disease prevention, so treatment aimed at lowering blood homocysteine levels is not recommended for most people who do not have severe hyperhomocysteinemia. Some studies suggest that lowering homocysteine levels may decrease the risk of stroke. However, while the overall risk of stroke decreased in these studies, the severity of the stroke and the amount of disability were not affected. More importantly, medications that affect platelet function such as aspirin, clopidogrel (Plavix), and aspirin-dipyridamole (Aggrenox) are recommended and are effective as secondary stroke prevention medications. There is uncertainty whether the risk of heart disease is affected.
Who should have their homocysteine levels tested?

Infants blood and urine are often checked for elevated homocysteine levels if they have a family history of the disease, or if they have certain medical conditions including eye lens dislocations, unusual (Marfan type) body shape, mental retardation, or signs of stroke.

Younger adults who have an early heart attack, stroke, or blood clots are often screened for blood clotting abnormalities including homocysteine blood tests.

Homocysteine levels are also often measured when a patient suffers a heart attack or stroke and has no risk factors for that illness (smoking, high blood pressure, high cholesterol, diabetes).

At present it is not recommended that individuals consuming normal diets with adequate folate levels be screened for elevated homocysteine levels.

REFERENCES:


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