CONDITION

Microangiopathic hemolytic anemia

Microangiopathic hemolytic anemia is red blood cell destruction caused by damage within small blood vessels.

WHAT IT IS
Red blood cell destruction within damaged small vessels

BODY SYSTEM
Blood, circulation, kidneys, and nervous system

MAIN SYMPTOMS
Fatigue, pale skin, breathlessness, dark urine

WHAT CAUSES IT
Small-vessel injury from several underlying conditions

HOW IT IS DIAGNOSED
Blood smear plus blood tests showing hemolysis

MAIN TREATMENT
Urgent treatment of the underlying cause

CAN IT BE CURED?
Sometimes - cause treatment can stop hemolysis

IS IT AN EMERGENCY?
Sometimes, especially with confusion or very low urine output

LONG-TERM OUTLOOK
Often good when treated before severe organ injury

Overview

Microangiopathic hemolytic anemia, or MAHA, is a pattern of red blood cell destruction. It happens when red blood cells are damaged as they travel through narrowed or injured small blood vessels.

"Microangiopathic" means involving very small blood vessels. "Hemolytic anemia" means that red blood cells are being destroyed faster than the body can replace them. This lowers the amount of hemoglobin, the protein that carries oxygen.

Under a microscope, damaged cells may appear as broken fragments called schistocytes . Blood tests also show signs that red blood cells are breaking down.

MAHA is not one specific disease. It can result from several conditions, including thrombotic

thrombocytopenic purpura, hemolytic uremic syndrome, severe pregnancy complications, overwhelming infection, or abnormal blood clotting. Some causes can injure the brain, kidneys, heart, or other organs.

Finding the cause matters because treatments are different. Some causes need emergency treatment even before every test result is available.

Symptoms

Symptoms may come from anemia, a low platelet count, or injury to organs. Platelets are blood cells that help stop bleeding.

Symptoms of anemia may include:

When platelets are being used up in small blood clots, you may bruise easily or develop pinpoint red or purple spots called petechiae. Serious bleeding is less typical but can occur.

Symptoms involving the brain can include confusion, difficulty speaking, weakness, severe headache, seizures, or reduced alertness. Kidney injury may cause less urine, swelling, nausea, or rising blood pressure. Chest pain or breathlessness can occur if the heart or lungs are affected.

Symptoms can develop quickly. In other situations, the changes are first found on blood tests performed for another reason.

- Unusual tiredness or weakness
- Pale skin
- Shortness of breath
- Dizziness, headache, or a fast heartbeat
- Yellowing of the skin or eyes
- Dark or reddish-brown urine

Causes and risk factors

MAHA develops when red blood cells are forced through small vessels containing clots, damaged vessel linings, or abnormal narrowing. The cells become stretched and fragmented.

Important causes include:

Red blood cell fragmentation can also occur around an abnormal or malfunctioning mechanical heart valve. This is usually described as mechanical hemolysis rather than a small-vessel

disorder, but the blood test pattern can look similar.

Having MAHA does not by itself show which cause is responsible. The surrounding symptoms, medical history, examination, and additional tests are essential.

- Thrombotic thrombocytopenic purpura (TTP): Small clots form because an enzyme called ADAMTS13 is severely reduced. Most cases are caused by an immune reaction against the enzyme. Rare cases are inherited.
- Hemolytic uremic syndrome (HUS): This often includes red blood cell destruction, low platelets, and kidney injury. Some cases follow infection with Shiga toxin-producing bacteria. Others involve uncontrolled activity of part of the immune system called complement.
- Disseminated intravascular coagulation (DIC): Abnormal clotting develops throughout the body, often during severe infection, major trauma, cancer, or pregnancy complications.
- Pregnancy-related conditions: Severe pre-eclampsia, eclampsia, and HELLP syndrome can cause MAHA. HELLP stands for hemolysis, elevated liver enzymes, and low platelets.
- Severely high blood pressure: A sudden, major rise in blood pressure can damage small vessels.
- Cancer or stem cell and organ transplantation: These can sometimes injure vessel linings or trigger widespread clotting.
- Certain medicines: Some medicines can cause immune reactions or direct injury to small vessels. The risk is specific to the medicine and clinical situation.

Diagnosis

MAHA is identified using a combination of a complete blood count, a blood smear, and tests for red blood cell destruction.

The complete blood count may show low hemoglobin and, in many causes, a low platelet count. A laboratory professional examines a blood smear for schistocytes. A small number of fragments can occur in other settings, so the result must be interpreted with the other findings.

Typical laboratory signs of hemolysis include:

A direct antiglobulin test, also called a direct Coombs test, is usually negative. This helps distinguish MAHA from many forms of immune hemolytic anemia, although exceptions and overlapping conditions can occur.

Tests to find the cause may include kidney and liver tests, clotting tests, urine testing, blood

pressure measurement, infection testing, and pregnancy-related assessment.

If TTP is suspected, blood is tested for ADAMTS13 activity and for antibodies against ADAMTS13. Very low activity strongly supports TTP. Because delayed treatment can be dangerous, clinicians may begin treatment while the result is pending.

Stool testing may be used when diarrhea-associated HUS is possible. Complement testing and sometimes genetic testing may be considered for suspected complement-mediated HUS. Tests for DIC look for abnormal clotting and increased breakdown of clots.

- Increased lactate dehydrogenase, or LDH, released from damaged cells
- Increased indirect bilirubin, produced as hemoglobin is broken down
- Low haptoglobin, a protein that binds free hemoglobin
- Increased reticulocytes, which are young red blood cells
- Hemoglobin in the urine in some cases

Treatment and management

Treatment focuses on the cause and on supporting affected organs. MAHA itself is not treated with one standard medicine.

Suspected TTP requires urgent specialist care. Treatment commonly includes plasma exchange, which removes harmful antibodies and replaces the missing ADAMTS13 enzyme. Medicines that reduce the immune attack or limit abnormal platelet clumping may also be used.

Shiga toxin-associated HUS is usually managed with close monitoring and supportive care. This may include careful fluid management, blood transfusion, blood pressure treatment, and temporary dialysis if the kidneys cannot adequately remove waste and fluid. Treatment choices during a diarrheal illness are based on the organism and clinical situation.

Complement-mediated HUS may be treated with medicines that block complement activity. These treatments require specialist assessment because serious infections must be considered and preventive measures may be needed.

For DIC, treatment targets the trigger, such as severe infection, trauma, or a pregnancy complication. Blood products may be needed if there is significant bleeding or a procedure is required.

Pregnancy-related MAHA needs urgent obstetric and medical assessment. Management depends on the cause, the health of the pregnant person and fetus, and the stage of

pregnancy.

A medicine linked to MAHA may need to be stopped or changed under medical supervision. Mechanical heart valve problems may require cardiac testing and correction of the valve problem.

Red blood cell transfusions can be used when anemia is severe or causing important symptoms. Platelet transfusions are handled cautiously in some clotting conditions, particularly TTP, and are generally reserved for specific situations such as serious bleeding.

Complications

Complications depend on the cause and how quickly it is controlled. Reduced blood flow through small vessels can damage organs even when external bleeding is absent.

Possible complications include:

Some organ injury improves after treatment. Severe or prolonged injury can leave lasting kidney, neurological, or heart problems.

- Acute kidney injury, sometimes requiring temporary or long-term dialysis
- Stroke, seizures, confusion, or other neurological problems
- Heart injury or abnormal heart rhythms
- Severe anemia
- Bleeding related to very low platelets or abnormal clotting
- Blood clots in small or larger vessels
- Pregnancy complications affecting the pregnant person or fetus

Prevention

MAHA cannot always be prevented because it is a complication of several different conditions. Inherited forms cannot be prevented, although knowing the diagnosis may help with monitoring and family counselling.

Food hygiene and handwashing can reduce exposure to some infections that cause Shiga toxin-associated HUS, but they cannot remove all risk.

If you take a medicine associated with blood cell or small-vessel problems, follow the recommended blood-test schedule and report new symptoms. Do not stop a prescribed medicine without medical advice unless emergency services direct you to do so.

Managing blood pressure and attending follow-up for a mechanical heart valve may reduce the chance of vessel or blood cell damage linked to those problems.

Living with it and what to expect

MAHA may resolve completely when a temporary cause is controlled. Blood counts and hemolysis markers often improve as red blood cell damage stops, but organ recovery can take longer.

TTP can return after successful treatment. Follow-up may include blood counts, LDH, and ADAMTS13 testing. Some people receive treatment when ADAMTS13 falls before symptoms return. The follow-up plan is based on specialist assessment.

Recovery after HUS depends greatly on kidney injury and the underlying type. Some people regain normal kidney function, while others need ongoing checks for high blood pressure, protein in the urine, or reduced kidney function.

Complement-mediated conditions can relapse, especially during infections, pregnancy, or other physical stress. Long-term complement-blocking treatment is appropriate for some people, but not everyone.

During recovery, tiredness may last after the blood count improves. Activity can usually be increased gradually. Follow-up is important because blood tests may detect a relapse or continuing organ problem before symptoms become obvious.

When to get medical help

Newly suspected MAHA needs prompt medical assessment. If a blood test shows schistocytes together with anemia or low platelets, contact the clinician who ordered the test the same day unless a clear follow-up plan has already been provided.

Seek urgent medical care for new dark urine, yellow skin or eyes, marked weakness, unexplained bruising, reduced urination, or worsening swelling. During pregnancy or soon after delivery, urgent assessment is needed for severe headache, vision changes, upper abdominal pain, high blood pressure, or sudden swelling.

Call emergency services for:

These symptoms can indicate serious organ injury. Do not wait for a routine appointment.

- New confusion, fainting, seizure, or difficulty waking

- Sudden weakness, facial drooping, or trouble speaking
- Chest pain or severe difficulty breathing
- Little or no urine with rapidly worsening illness
- Heavy or uncontrolled bleeding

Common questions

Is microangiopathic hemolytic anemia the same as TTP?

No. TTP is one important cause of MAHA. HUS, DIC, severe high blood pressure, pregnancy complications, cancer, transplantation, and certain medicines can produce a similar blood pattern.

Does finding schistocytes mean I have MAHA?

Not by itself. Schistocytes are fragmented red blood cells. Their number, the quality of the blood sample, other hemolysis tests, platelet count, symptoms, and medical history all affect what the result means.

Can microangiopathic hemolytic anemia go away?

Sometimes. MAHA may stop when an infection, pregnancy complication, medication reaction, blood pressure emergency, or other trigger is controlled. Some underlying conditions can return or need long-term monitoring.

Is microangiopathic hemolytic anemia cancer?

MAHA is not cancer. However, some cancers and cancer treatments can trigger small-vessel injury or abnormal clotting that causes MAHA. Most people with MAHA need testing for several possible causes rather than assuming cancer is responsible.

Is microangiopathic hemolytic anemia inherited?

Usually not. Most cases are caused by acquired conditions. Rare inherited forms include congenital TTP and some complement-related disorders. Genetic counselling or testing may be offered when personal and family history suggest an inherited cause.

How quickly does treatment work?

The timing differs by cause and the amount of organ injury. Blood tests may begin improving within days after effective treatment, while tiredness, kidney function, or neurological symptoms can take longer. Continued testing helps show whether red blood cell destruction has stopped.

Sources

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