CONDITION

# Arteriovenous malformation

Learn what an arteriovenous malformation is, possible symptoms, how brain and body AVMs are diagnosed, and how specialists weigh monitoring and treatment.

**WHAT IT IS**
Abnormal blood-vessel group bypassing capillaries

**BODY SYSTEM**
Heart and circulation

**MAIN SYMPTOMS**
Seizures, headaches, weakness or numbness, speech or vision problems

**WHAT CAUSES IT**
Usually unknown, sometimes inherited

**HOW IT IS DIAGNOSED**
CT angiography, MRI or catheter angiography

**MAIN TREATMENT**
Observation, surgery, embolization or radiosurgery

**CAN IT BE CURED?**
Sometimes, complete surgical removal eliminates it

**IS IT AN EMERGENCY?**
Sometimes, with severe headache or stroke-like symptoms

**LONG-TERM OUTLOOK**
Variable, with possible lasting disability or death

## Overview

An arteriovenous malformation, or AVM, is an abnormal group of blood vessels. In a typical circulation, arteries carry blood from the heart into smaller vessels called capillaries. Capillaries slow blood flow and allow oxygen to reach nearby tissue. Veins then return the blood to the heart.

In an AVM, blood passes directly from arteries into veins without a normal capillary network between them. Many AVMs contain a tangled center called a nidus . The high-pressure blood coming from the arteries can place stress on the AVM and its draining veins.

AVMs can develop in the brain, spinal cord, skin, muscles, bones, or internal organs. This article focuses mainly on brain AVMs because they may cause seizures, bleeding in the brain, or stroke-like symptoms. AVMs elsewhere in the body can cause pain, swelling, skin changes,

bleeding, or strain on the heart, depending on their size and location.

An AVM is not the same as a brain aneurysm. An aneurysm is a weakened, bulging area in a blood vessel wall. Some people have both conditions, but they are evaluated separately. An AVM is also different from a cavernous malformation, which is another type of abnormal blood-vessel cluster with slower blood flow.

Some AVMs are found only after they cause symptoms. Others are discovered unexpectedly during imaging performed for another reason. Finding an AVM does not automatically mean that immediate treatment is needed. The safest plan depends on its location, blood-flow pattern, history of bleeding, symptoms, and the risks of each treatment option.

## Symptoms

A brain AVM may cause no symptoms. When symptoms occur, they vary according to the part of the brain involved.

Possible symptoms include:

Headaches are common and usually have causes other than an AVM. The presence or pattern of a headache cannot confirm whether an AVM is present or bleeding.

A spinal AVM may cause back pain, weakness, numbness, walking problems, or changes in bladder or bowel control. Symptoms can develop suddenly or gradually.

An AVM in another part of the body may produce warmth, swelling, pain, visible enlarged veins, a reddish or bluish skin patch, or a lump that seems to pulse. Some internal AVMs can cause bleeding. Very large AVMs may divert enough blood to place added work on the heart.

Call emergency services for a sudden, severe headache; a first seizure; a seizure that does not stop promptly; loss of consciousness; new weakness or numbness; facial drooping; trouble speaking; sudden vision loss; severe confusion; or difficulty walking. These can be signs of bleeding or another neurological emergency. Do not drive yourself.

Less sudden concerns, such as recurring headaches, brief unusual sensations, or a slowly changing skin lesion, can usually be discussed through routine or prompt outpatient care. Contact a clinician sooner if symptoms are new, worsening, or affecting daily activities.

- A seizure, with or without loss of awareness
- Headaches that may be localized or recurring
- Weakness, numbness, or difficulty coordinating movement
- Problems with speech, understanding, vision, memory, or balance

- A pulsing or whooshing sound, especially if the AVM is near the ear
- Sudden neurological symptoms caused by bleeding

## Causes and risk factors

Most brain AVMs are thought to form during early blood-vessel development. The exact biological cause is often unknown. An AVM is not generally caused by diet, exercise, stress, or something a person did.

Most AVMs occur without a known family history. In some people, however, abnormal blood vessels are part of an inherited condition. The best-known example is hereditary hemorrhagic telangiectasia, or HHT. HHT can cause frequent nosebleeds, small red spots on the skin or inside the mouth, and AVMs in organs such as the lungs, liver, or brain.

A family history of HHT or multiple relatives with unusual blood-vessel problems may lead a clinician to consider genetic counseling. Having one relative with an isolated brain AVM does not necessarily mean that other family members need screening.

Features that may affect the chance of a brain AVM bleeding include a previous hemorrhage, its location and drainage pattern, and related vessel abnormalities such as aneurysms. These features must be interpreted together by specialists. AVM size alone does not determine whether treatment is necessary or safe.

Pregnancy changes blood volume and circulation. A person with a known AVM who is pregnant or planning pregnancy should discuss individual risks with a neurologist, neurosurgeon, and obstetric team. Pregnancy is not managed the same way for every AVM.

## Diagnosis

A clinician begins by reviewing symptoms, prior bleeding, family history, and any previous imaging. A neurological examination checks strength, sensation, coordination, speech, vision, and mental function. An AVM cannot be confirmed from symptoms alone.

Computed tomography, or CT, is often the first test when sudden brain bleeding is suspected. It uses X-rays to create detailed images and can identify fresh blood quickly. CT angiography uses contrast material to show blood vessels.

Magnetic resonance imaging, or MRI, provides detailed pictures of the brain, spinal cord, or soft tissues. Magnetic resonance angiography focuses on the blood vessels. These tests can show the AVM and whether nearby tissue has been affected by old or recent bleeding.

A catheter cerebral angiogram gives the most detailed view of a brain AVM's blood supply and drainage. During this procedure, a specialist guides a thin tube through an artery, usually from the wrist or groin, and injects contrast material while taking X-ray images. Angiography helps with treatment planning, but it is invasive and has risks that should be discussed beforehand.

Ultrasound, MRI, CT angiography, or catheter angiography may be used for AVMs outside the brain. The choice depends on the body area and the information needed.

Doctors describe brain AVMs by features such as size, location, nearby brain function, feeding arteries, and draining veins. These details help a multidisciplinary team estimate the relative risks of observation, surgery, radiation treatment, or an endovascular procedure.

## Treatment and management

Management should be individualized. Ideally, a brain AVM is reviewed by a team that may include a vascular neurologist, neurosurgeon, interventional neuroradiologist, and radiation specialist. For an AVM elsewhere in the body, the team may include vascular-anomaly specialists, surgeons, dermatologists, or other organ-specific clinicians.

Observation may be reasonable when an unruptured AVM is not causing significant problems or when treatment risks appear greater than its expected benefit. Observation does not mean ignoring the condition. It usually involves scheduled clinical reviews, imaging when appropriate, and instructions about symptoms that require urgent care.

Treatment options for a brain AVM include:

A ruptured AVM may first require emergency care for brain bleeding, pressure, fluid buildup, or seizures. Definitive AVM treatment may occur immediately or later, depending on the person's condition and the anatomy of the AVM.

Research has shown that preventive procedures can carry important short-term risks for some people with unruptured brain AVMs. However, AVMs vary widely, and available studies do not answer every long-term question. Decisions should be based on the specific anatomy, symptoms, age and overall health of the patient, local expertise, and the person's priorities.

Medicines do not remove an AVM. They may be used to manage seizures, headaches, blood pressure, or other related problems. Patients should not start or stop prescription medicines, including blood thinners or anti-seizure medicines, without discussing the change with the clinician who manages them.

- Microsurgical removal: A neurosurgeon opens the skull and removes the AVM. This can eliminate the AVM immediately when complete, but the safety of surgery depends greatly on its location and complexity.
- Endovascular embolization: A specialist guides a catheter into feeding blood vessels and delivers material that blocks some or all blood flow. Embolization is often used before surgery or radiosurgery, although it may be the main treatment in selected cases.
- Stereotactic radiosurgery: Focused radiation is directed at the AVM without an open incision. The vessels close gradually, often over an extended period, so bleeding risk does not disappear immediately.
- Combined treatment: Some AVMs are managed with more than one technique.

## Complications

The main concern with a brain AVM is hemorrhage, meaning bleeding into or around the brain. Bleeding may damage brain tissue and cause a hemorrhagic stroke. The effects can include weakness, speech or vision problems, seizures, memory changes, loss of independence, or, in severe cases, death.

An AVM can also cause seizures without bleeding. Altered blood flow may irritate nearby brain tissue. Some people develop persistent neurological difficulties due to pressure, blood-flow changes, or previous hemorrhage.

Possible treatment complications include bleeding, stroke, infection, seizures, vessel injury, or new neurological problems. Radiation treatment can cause delayed swelling or injury to nearby tissue. Embolization or surgery may not fully eliminate every AVM, and further treatment may sometimes be considered.

Spinal AVMs can injure the spinal cord and lead to lasting weakness, sensation changes, or bladder and bowel problems. Large AVMs elsewhere in the body may cause repeated bleeding, skin damage, pain, reduced function, or high-output heart failure, in which the heart must work harder to handle abnormal blood flow.

These complications are possible, not inevitable. A specialist can explain which concerns are most relevant to a particular AVM.

## Follow up

Follow-up depends on whether the AVM is being observed or treated. Routine appointments

may include a symptom review, neurological examination, discussion of medicines, and repeat imaging. Keep copies of imaging reports when possible, especially if care is provided by more than one medical center.

After treatment, imaging is used to determine whether abnormal blood flow remains. A catheter angiogram may be needed because MRI or CT does not always show the smallest remaining vessels. Follow-up is especially important after radiosurgery because vessel closure is gradual.

Attend scheduled visits even when you feel well. Contact the care team promptly for new seizures, changing headaches, new weakness or numbness, speech or vision changes, increasing pain or swelling, or new bleeding from a body AVM. Sudden severe or stroke-like symptoms require emergency care rather than waiting for a routine appointment.

Ask before making major changes to physical activity, pregnancy plans, or medicines. There is no single activity restriction that applies to everyone with an AVM. General cardiovascular care, including avoiding tobacco and managing diagnosed high blood pressure, supports overall health but cannot guarantee that an AVM will not bleed.

## Sources

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