CONDITION

Cerebral arteriovenous malformation

Learn how a cerebral arteriovenous malformation affects blood vessels in the brain, including possible symptoms, testing, treatment options, and follow-up care.

WHAT IT IS
Abnormal group of brain blood vessels

BODY SYSTEM
Nervous system

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

WHAT CAUSES IT
Usually unknown, rarely inherited

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

MAIN TREATMENT
Observation, surgery, embolization or radiosurgery

CAN IT BE CURED?
Sometimes, complete treatment can close it

IS IT AN EMERGENCY?
Sometimes, with a sudden severe headache

LONG-TERM OUTLOOK
Variable, from no symptoms to life-threatening bleeding and permanent disability

Overview

A cerebral arteriovenous malformation, or brain AVM, is an abnormal group of blood vessels in the brain. Arteries normally carry oxygen-rich blood from the heart into smaller vessels called capillaries. Capillaries slow the blood flow and allow oxygen to reach brain tissue. Blood then returns through veins.

In an AVM, arteries connect to veins without a normal capillary network between them. Blood can flow through these connections at high pressure and speed. This may place stress on the abnormal vessels and the veins that drain them.

Some brain AVMs never cause symptoms. Others may lead to seizures, headaches, or problems with speech, movement, vision, or sensation. An AVM can also rupture and cause bleeding in or around the brain, known as an intracranial hemorrhage. Bleeding may cause

brain injury and can be life-threatening.

An AVM's effects depend on its size, location, pattern of blood flow, and whether it has bled before. Management is therefore highly individualized. A team may include a neurologist, neurosurgeon, interventional neuroradiologist, and radiation specialist.

Symptoms

A brain AVM may be found by chance during imaging performed for an unrelated reason. When symptoms occur, they can vary widely.

Possible symptoms include:

These symptoms are not specific to an AVM. Many other medical conditions can cause them. A clinician can assess the symptoms and decide whether brain imaging or other testing is appropriate.

Bleeding from an AVM often causes symptoms that begin suddenly. Call emergency services for:

Do not drive yourself if stroke-like symptoms or a major seizure occurs. Emergency assessment is important even if the symptoms begin to improve.

- A seizure, which may cause staring, loss of awareness, unusual sensations, or uncontrolled movements
- Headaches that may be persistent, recurrent, or different from previous headaches
- Weakness, numbness, or loss of coordination
- Difficulty speaking or understanding language
- Changes in vision
- Problems with memory, thinking, or balance
- A rhythmic sound in the ear that follows the heartbeat, called pulsatile tinnitus
- A sudden, severe headache, especially one that peaks within seconds or minutes
- New weakness, numbness, facial drooping, trouble speaking, confusion, vision loss, or severe loss of balance
- A first seizure, a seizure lasting more than five minutes, or repeated seizures without recovery
- Fainting, extreme drowsiness, difficulty waking, or trouble breathing
- Sudden symptoms during pregnancy or soon after delivery

Causes and risk factors

Most cerebral AVMs are thought to develop before birth or during early blood-vessel development. The exact reason is usually unknown. An AVM is not caused by something a person did, and most are not passed directly from parent to child.

Rare inherited blood-vessel disorders can increase the chance of having an AVM. One example is hereditary hemorrhagic telangiectasia, or HHT. People with HHT may have frequent nosebleeds, small abnormal blood vessels on the skin or inside the mouth, and AVMs in organs such as the brain, lungs, or liver. Genetic counseling may be appropriate when personal or family features suggest HHT.

Certain AVM features have been associated with a higher chance of bleeding. These include a previous rupture, a deep location in the brain, drainage into deep veins, and an aneurysm related to the AVM. An aneurysm is a weakened, bulging area in a blood vessel. These findings do not predict exactly what will happen to one person, but they can help specialists discuss risk.

Pregnancy changes blood volume and circulation. Someone with a known AVM who is pregnant or planning pregnancy should discuss care with both an AVM specialist and an obstetric team experienced in higher-risk pregnancy. This allows planning without assuming that every AVM requires treatment before pregnancy.

Diagnosis

Diagnosis begins with a medical history and neurological examination. The clinician may check strength, sensation, speech, vision, coordination, reflexes, and alertness. Imaging is needed to identify an AVM and understand its structure.

A noncontrast computed tomography, or CT, scan is often the first test when sudden brain bleeding is suspected. CT uses X-rays to produce detailed images and can quickly show fresh blood.

CT angiography uses contrast material to display the arteries and veins. It may identify an AVM, an associated aneurysm, or the source of bleeding.

Magnetic resonance imaging, or MRI, provides detailed pictures of the brain and can show an AVM, previous bleeding, and effects on nearby tissue. Magnetic resonance angiography, or MRA, focuses on blood vessels. MRI takes longer than CT and may not be suitable for every medical device or implant.

Catheter cerebral angiography provides the most detailed view of an AVM's blood supply and

drainage. A specialist guides a thin tube, usually from an artery at the wrist or groin, toward vessels supplying the brain. Contrast is injected while X-ray images are taken. This test can help plan surgery, embolization, or focused radiation treatment. Because it is invasive, the team should explain risks such as bleeding at the catheter site, contrast reactions, blood-vessel injury, and stroke.

Specialists may describe an AVM using a grading system based on factors such as size, location, and venous drainage. A grade helps with treatment planning, but it is not a complete prediction of an individual outcome.

Treatment and management

Treatment decisions require careful comparison of the risks from the AVM with the risks of an intervention. Important factors include whether the AVM has ruptured, its anatomy and location, the person's symptoms and general health, and the experience of the treating center.

For an unruptured AVM, observation may be reasonable in some situations. A randomized trial called ARUBA found fewer strokes or deaths over its initial follow-up period among participants managed without an intervention. However, the study had important limitations, including relatively short follow-up for a lifelong condition and limited representation of some treatment approaches. Its findings do not mean that every unruptured AVM should be observed. Decisions should be made with a specialist team familiar with current evidence.

Management options include the following:

Some people receive more than one type of treatment. For example, embolization may reduce blood flow before surgical removal. The team should explain whether the goal is complete closure, risk reduction, symptom control, or preparation for another procedure.

A seizure related to an AVM may be treated with antiseizure medicine. The choice of medicine depends on seizure type, other health conditions, pregnancy considerations, side effects, and possible interactions. Do not stop an antiseizure medicine suddenly unless a clinician directs you to do so.

Tell the treating team about all prescription medicines, nonprescription products, and supplements. Do not start or stop aspirin, anticoagulants like warfarin or apixaban , or other medicines that affect bleeding without discussing the reason they are used and the potential risks.

- Observation and medical management: This may involve scheduled clinical visits and imaging. Clinicians can also treat seizures or headaches when needed and address general cardiovascular health. Medicines can control symptoms, but they do not remove the AVM.
- Microsurgical removal: A neurosurgeon opens the skull and separates the AVM from surrounding brain tissue. Successful complete removal can eliminate the future bleeding risk from that AVM. Surgery may be more suitable for accessible AVMs where the expected neurological risk is acceptable. Possible complications include bleeding, infection, seizure, stroke, and new problems with movement, speech, vision, or thinking.
- Endovascular embolization: A specialist passes a catheter through the blood vessels and delivers an agent that blocks part or all of the abnormal blood flow. Embolization is often used before surgery or focused radiation, but it may be the main treatment in selected cases. More than one procedure may be needed. Blocking only part of an AVM does not necessarily remove the long-term risk.
- Stereotactic radiosurgery: Precisely focused radiation is directed at the AVM without a surgical incision. The radiation causes the abnormal vessels to thicken and gradually close. Closure usually takes time, so bleeding can still occur during the waiting period. This approach is often considered for smaller AVMs that are difficult to reach safely with open surgery.

Complications

The main complication of a brain AVM is bleeding. Blood may collect within the brain, between the brain and its coverings, or in the fluid-filled spaces of the brain. The effects depend on the amount and location of bleeding.

Possible consequences include stroke, permanent neurological disability, seizures, problems with memory or mood, and difficulty with speech, movement, vision, or swallowing. A large hemorrhage can increase pressure inside the skull or interfere with normal circulation of brain fluid.

Treatment also carries risks. Surgery, embolization, angiography, and radiosurgery can cause bleeding, blood-vessel blockage, stroke, seizure, or injury to nearby brain tissue. Focused radiation may cause delayed swelling or radiation-related tissue changes. An AVM that is only partly treated may continue to carry a bleeding risk.

These possibilities should be discussed in terms of the person's specific anatomy. General complication lists cannot show whether a particular procedure is safer than continued observation for one individual.

Follow up

Follow-up depends on whether the AVM is being observed, has been treated, or has previously bled. Routine care may include neurological examinations, review of headaches or seizures, and repeat MRI, MRA, CT angiography, or catheter angiography.

After treatment, imaging is used to check whether the AVM has closed completely. A person may need monitoring even when an early scan looks reassuring. The type and timing of imaging depend on the treatment used, the person's age, and the specialist team's findings.

Attend scheduled visits and report changes in seizure pattern, headaches, memory, balance, or daily function. Contact the care team promptly about treatment side effects, increasing symptoms, or difficulty taking prescribed medicine.

Sudden severe headache, a new neurological problem, loss of consciousness, or a prolonged or repeated seizure requires emergency care rather than waiting for a routine appointment.

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