



## Arteriovenous Malformations (AVMs)

Arteriovenous malformations or AVMs are abnormal connections or passageways between arteries and veins. They are most commonly found in the brain, neck and spine. However, they may also appear in the arms, legs, lungs, liver and reproductive system.

Your doctor may perform a variety of tests depending on your type of AVM. Some AVMs have no symptoms and cause no problems. Your doctor may monitor your condition or neutralize the AVM using surgery, radiation therapy or embolization.



## What are Arteriovenous Malformations (AVMs)?

Arteriovenous malformations (AVMs) are abnormal connections or passageways between the arteries and veins. They occur most commonly in the brain, neck and spine, but they are also found in the arms, legs, lungs, liver and reproductive system.

AVMs cause blood to bypass the capillaries, the smallest blood vessels, and pass directly from the arteries to the veins. Some AVMs cause no problems. Others may eventually burst and bleed causing serious problems. Most episodes of bleeding are not severe enough to cause permanent damage. However, significant bleeding can occur. If the AVM is in the brain, this bleeding can cause stroke or brain damage.

Peripheral AVMs develop outside of the head, neck and spine. They reduce the blood supply to the surrounding tissue. Over time, this can damage the tissue and cause pain and ulcers, or open sores, on the skin. This may also force your heart to work harder to circulate blood.

Most AVMs are present at birth. Some AVMs are post-surgical or acquired. Some people with an AVM have no significant symptoms. AVMs in the head, neck and spine may cause:

- headaches
- neck pain
- weakness
- seizures

- an unusual sound, such as humming, pulsations or swishing, in one ear
- double vision
- increased pressure in the eye (glaucoma)
- eye swelling, decreased vision, redness and congestion of the eye
- problems with speech, vision, or movement.
- prominent blood vessels on the scalp and above the ear

Symptoms of peripheral AVMs include:

- shortness of breath on exertion
- coughing up blood (if AVMs are in the lungs)
- bleeding
- abdominal pain
- black stools (if AVMs involve the digestive system)
- anemia
- swelling
- lumps on the trunk and limbs
- sores and ulcers on the skin
- pain

## How are AVMs diagnosed and evaluated?

AVMs tend to be found during treatment for an unrelated disorder.

Doctors may perform the following imaging tests for brain AVMs:

- **Head computed tomography (CT):** CT scanning combines special x-ray equipment with sophisticated computers to produce multiple images or pictures of the inside of the body. To improve the detection and characterization of AVMs, CT angiography (CTA) may be performed. In CTA, a contrast material may be injected into a vein while images are obtained of the blood vessels. Images that detect blood flow, called CT perfusion (CTP), may be obtained at the same time. The combination of these scans can help physicians decide on the best therapy for a patient with an AVM.
- **Head magnetic resonance imaging (MRI):** MRI uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. MR is also used to image the vessels, a procedure called MR angiography (MRA), and contrast may be injected into a vein to help obtain the best pictures. A procedure called MR perfusion (MRP) that produces images of blood flow may also be performed.

Doctors may perform the following imaging tests for peripheral AVMs:

- **Ultrasound:** Ultrasound imaging uses sound waves to produce pictures of the inside of the body. Ultrasound is commonly the first procedure used to image peripheral AVMs.
- **Angiography:** Angiography produces pictures of major blood vessels supplying the AVM. A thin plastic tube called a catheter is inserted into a blood vessel and contrast is injected into the vessels supplying the AVM while taking X-rays. This delivers very detailed pictures of the AVM. The

doctor can sometimes treat the AVM at the same time.

- **Body computed tomography (CT):** CT can show AVMs in different parts of the body. As with CT of the head, a body CT scan may involve the injection of contrast medium. Body CT may also include CT angiography (CTA) and CT perfusion (CTP).
- **Body magnetic resonance imaging:** Doctors may use MRI to help diagnose AVMs in other parts of the body. MR angiography (MRA) and MR perfusion (MRP) may be used as part of this exam.

These imaging tests can provide information about the location and size of the AVM. They also may be able to reveal the extent of any bleeding in the area.

## How are AVMs treated?

Most AVMs do not require immediate treatment. However, all patients with AVMs should consult with a specialist. It is important to know that AVMs do not go away on their own. Treatment options depend on various factors, including symptoms, the location of the AVM, and the individual's overall health. The decision to treat an AVM requires careful consideration of the benefits versus risks.

Primary treatment options include:

- **Medical management of symptoms:** Medication can often treat symptoms like headache, back pain and seizures caused by AVMs. For peripheral AVMs, compression sleeves (elastic garments) may reduce swelling in an arm or leg; however, these are often not helpful. Patients with peripheral AVMs should seek care at a vascular anomalies clinic with interventional radiologists who have experience treating AVMs. A person with a cerebral AVM should have regular checkups with a neurologist, neurointerventional radiologist or neurosurgeon.
- **Surgery:** Surgical removal is an option if a brain AVM has bled and is located in an area that can be easily operated upon. The procedure is performed under general anesthesia. The doctor gains access to the brain AVM by removing a portion of the skull. Some peripheral AVMs can be treated surgically if they are small enough. Removal of the AVM when possible will usually eliminate the possibility of any further bleeding.
- **Stereotactic radiosurgery:** Sometimes a brain AVM may be in an area that's difficult to access by surgery. Stereotactic radiosurgery is an option in these cases. In the procedure, high-energy, focused beams of radiation are concentrated on the brain AVM. This damages the vessels and forms a clot to seal off the AVM.
- **Embolization of AVMs:** Embolization is much less invasive than surgery. In the procedure, a thin plastic tube is inserted into an artery. The doctor maneuvers it to the site of the AVM under imaging guidance. A special type of liquid glue, metallic coils, or other substance is then placed or released to stop blood flow to the AVM. This approach may require a series of treatments. Some AVMs may be embolized prior to surgical removal.

After treatment, you may need follow-up imaging to make sure the AVM is completely removed or destroyed. There is still a risk of bleeding if some of the AVM remains after treatment.

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