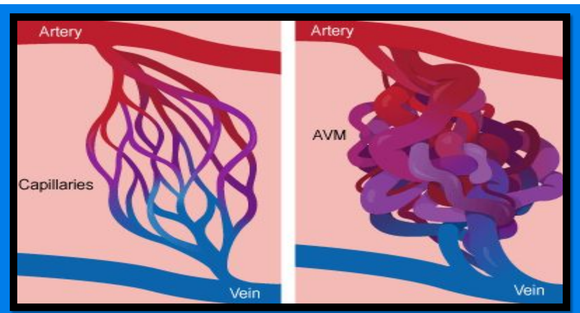
Arteriovenous Malformation of the Brain

Introduction

An arteriovenous malformation (AVM) is a tangle of abnormal blood vessels.[1] Arteries and veins are the body's two main types of blood vessels. Arteries carry oxygenated blood from the heart to the body. Whereas, veins are responsible for carrying deoxygenated blood from the body back to the heart. In normal circulation, blood flows from arteries to capillaries and then to veins. When an AVM occurs, blood flows directly from arteries to veins through a fistula; increasing flow and pressure. Over time, the vessels fatigue, leading to rupture.[2] AVMs are most common in the brain and spine and are extremely rare, affecting only 1% of the population.[2]

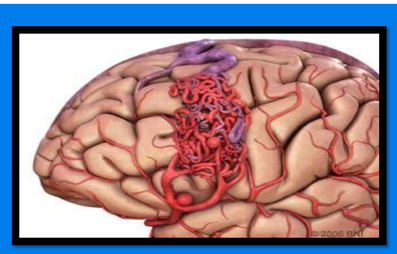


Symptoms

Brain AVMs are typically congenital[3] and affect men more than women. People with AVMs are typically asymptomatic unless rupture occurs. Rupture results in an intracranial hemorrhage.[3] In about ½ of all brain AVMs, hemorrhage is the first sign.[1]

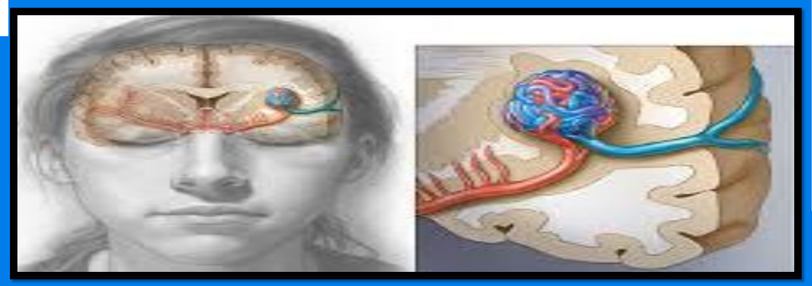
Other symptoms include:[3]

- Seizures (20-25%)
- Difficulty with movement, speech, vision (15%)
- Headaches



Types of AVM's

1. True Arteriovenous Malformation
   - Most common brain vascular malformation.[3]
2. Occult or cryptic AVM
   - Brain vascular malformation that may cause seizures.
3. Venous Malformation
   - Abnormality of the veins, not veins and arteries.
4. Hemangioma
   - Abnormal blood vessel structures usually found at the surface of the brain and on the skin or facial structures.[3]
5. Dura Fistula
   - Occurs when there is an abnormal connection between the surface of the brain and the blood vessels.
   - May occur on the top of the head or behind the ear or eye.



Diagnosing with Radiology

A. Computed Tomography Angiography (CTA)
- CTA uses a series of x-rays to create a cross-sectional image of the brain.[2] Iodine based contrast dye is injected intravenously so the blood circulation can be visualized.

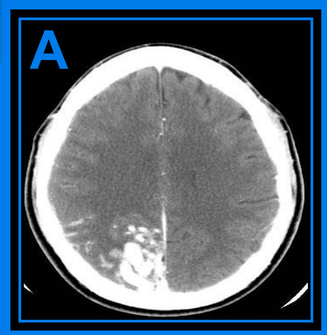
B. Magnetic Resonance Angiography (MRA)
- MRI uses a powerful magnet to create highly detailed images of the brain without radiation.[2] An MRA is a type of MRI. MRA can be done with or without the contrast dye, gadolinium. In an MRA, the blood flow creates the signal. MRI is more sensitive than CT and can show more subtle changes in brain tissue associated with a brain AVM.[1]

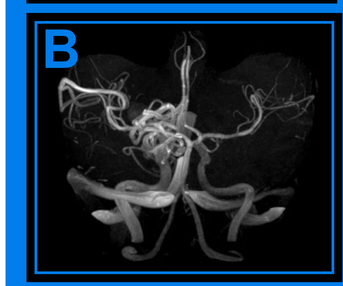
C. Cerebral Angiography
- The most detailed test to diagnose an AVM.[1] This test reveals the location and characteristics of the feeding arteries and draining veins, which is critical to planning treatment.[1] Neurosurgeon will insert a catheter into the femoral artery and guides the catheter to the head region using fluoroscopy and iodinated contrast dye. This provides an extremely detailed 3D map of the AVM, highlighting its location and characteristics.[2]

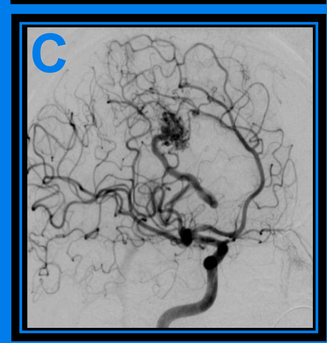
Treatment

The main goal of treating an AVM is to prevent hemorrhage. Neurosurgeons, endovascular surgeons, neurologist, and radiation oncologist[2] potentially all come together to determine the best treatment. The main components doctors take into consideration are; location, size, symptoms, and whether the AVM has hemorrhaged. Medications may be used to treat certain symptoms but surgery is the most common outcome. There are multiple options to consider.

1. Surgical removal
   - If the AVM has hemorrhaged or is easily accessible, removal is the best option for the patient. The neurosurgeon will temporarily remove part of the skull to gain access to the AVM.[1] The blood vessels are than either sealed off and carefully removed from other brain tissue or the AVM is completely removed.
2. Endovascular Embolism
   - This technique is less invasive than traditional surgery[1] and similar to an angiogram. The doctor will insert a catheter into the femoral artery to get access to the blood vessels. The catheter is positioned in one of the feeding arteries to the AVM.[1] An embolizing agent is than injected to block the artery and reduce blood flow to the AVM.
3. Radiosurgery
   - This non invasive technique uses precisely centered radiation beams to damage the blood vessel and potentially clot them off in 1-3 years following. This technique is mainly used for smaller AVM's that have yet to hemorrhage.







Conclusion

AVM's are unpredictable. The proportion of patients diagnosed with unruptured AVMs has almost doubled in the past three decades with improved non-invasive imaging.[4] Brain AVM's can occur anywhere in the brain. Their location is one of the main factors doctors use to determine treatment options. Radiology imaging is key to diagnose and treat an AVM.

Sources

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