Brain Arteriovenous Malformation

Definition
Arteriovenous Malformations (AVM) are congenital anomalies that consist of abnormal arteries and veins within an intervening capillary bed.1

Epidemiology
The incidence of AVMs is relatively uncommon and is approximately 1 per 100,000 per year in unselected population in the United States.2 Most patients diagnosed with AVMs are male adults and between 20 and 30 years of age.3,4

Pathophysiology
An AVM is a cluster of arteries and veins that lacks capillary linkage. AVMs arise from derangement in the developmental stage of vessel formation that prevents formation of capillaries.3,5 Arteriovenous malformation may also be resulted from trauma, either at birth or as the result of a head injury.3 A true AVM has a nidus (the Latin word nidus means nest) interposed between the arterial feeding vessels and draining vein.7

A large AVM is considered to be a large arteriovenous conduit with virtually no resistance to blood flow, as compared to the normal small vessels of the surrounding hemisphere that show higher resistance to the blood flow.3 As a result, AVMs divert blood away from adjacent brain tissue, which can cause ischemic changes (intracerebral steal phenomenon).5 Through the loss of the normal resistance to flow in the capillary bed, the AV shunt transmits arterial pressure to the compliant venous system, causing venous hypertension.9 Ten percent to fifty percent of patients with AVMs have aneurysm (saccular or fusiform types) on the feeding arteries and within the AVM nidus.9

Grading Scale of AVMs
The most commonly used grading scale to determine the treatment of choice for AVM is the system developed by Spetzler and Martin. This scale grades the AVM according the size, location, and venous drainage. Grading of an AVM is the sum of all three different components: size + location + deep venous drainage.10

Manifestations
At least 15% people are affected by AVMs are asymptomatic. Clinical presentations of AVMs depend on the size and location of the lesions. It includes intracranial hemorrhage, seizure, headache, and neurological deficit.1,3

More than 50% of AVMs present with intracranial hemorrhage. These hemorrhages could be intraparachymal, subarachnoid, or intraventricular. Patients with small nidus size and deep AVM carry higher risk of bleeding.2,3 Mortality rate from the first hemorrhage is between 10% and 30%, and 10% to 20% of survivors develop long-term disabilities.1

Seizures are the second most common manifestations of AVMs.11 They occur in 20% to 25% of cases. These seizures can be either partial, partial complex, or generalized.1,2,12 Patients with AVMs involving the frontal, temporal, and parietal lobes have higher incidences of developing seizures.12

Eight percent to fifteen percent of patients present with headaches, which can be a non-specific, hemicranial, throbbing, migraine like, or diffuse.1-5

Approximately 1% to 40% of patients present with focal neurological deficits. Research has suggested this is related to the steal phenomenon in which blood is diverted to the AVM from the adjacent brain tissue and causes ischemic damage.1,8

Diagnostic Tests
In addition to detail history taking and physical examination, computer tomography (CT scan), magnetic resonance imaging (MRI), and cerebral angiography are the three essential diagnostic tools for diagnosing AVMs.13

Magnetic Resonance Imaging is able to evaluate the AVM nidus size and its parenchymal morphological feature.1,2,4
Cerebral arteriogram is the “gold standard” for defining the arterial and venous anatomy of the AVMs. However, angiography is an invasive procedure and carries several risks of complications such as bleeding, nephrotoxicity and allergic reaction related to the used of radio-contrast media. A computer tomography scan without contrast may be able to detect any intracranial hemorrhage and/or calcification of the AVM. CT angiograms are able to reveal the three dimension AVM morphological features, its relationship with the cranium and any associated aneurysms.

A staged approach is usually performed for patients with large AVMs (either by embolization or stage surgery). The goal is to prevent post-operative complications by gradual increase perfusion to the previously hypoperfused areas. Post operative care includes monitoring patient’s blood pressure, neurological status, respiratory status, fluid and electrolytes, and lowering the blood pressure to prevent NPPB; a euolemic condition should be maintained.

Monitor any signs of pulmonary emboli, stroke, or temporary neurological deficit that is related to embolization material escaping into the circulatory system.

Provides a quite environment and restrict activities to avoid increases in intracranial pressure, seizures and bleeding. Administering prophylactic anti-epileptic agents, diuretics and steroids as prescript.

**References**


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