

Vascular Conditions of the Brain

Carotid Stenosis

Carotid artery stenosis occurs when cholesterol plaque builds up at the carotid bifurcation. Stenosis of the external carotid artery is not clinically significant, nor is stenosis of the common carotid artery (with rare exceptions). Stenosis of the internal carotid artery is clinically significant when the degree of stenosis is greater than 50% if symptomatic, or 60% if asymptomatic.

Carotid stenosis carries risk of **stroke**. An embolic stroke occurs when thrombus (blood clot) forms on a carotid plaque and breaks loose, traveling downstream to lodge in a smaller artery in the brain or retina. This stops blood flow to the smaller artery (called **ischemia**), causing cellular death to the tissue fed by the artery (called **infarction**). The worse (higher grade) the stenosis, the greater is the risk of stroke. Stroke can also occur if the internal carotid artery thromboses (clots off) entirely (called thrombotic stroke, Figure 1).

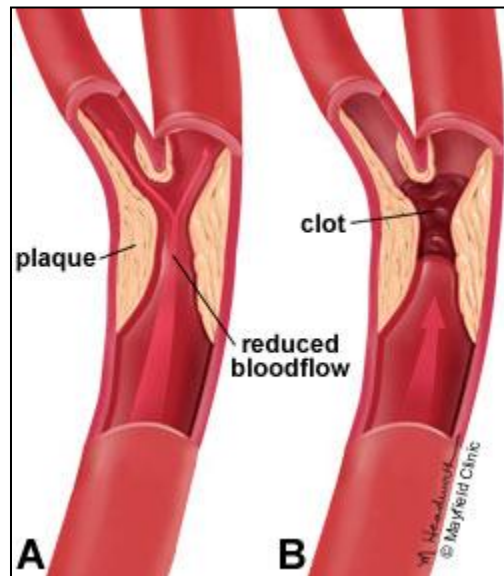


Figure 1: Carotid stenosis and thrombosis.

A. Carotid stenosis.

B. Thrombosis at the carotid bifurcation.

Occasionally patients will experience temporary ischemia to the brain (called **transient ischemic attack, or TIA**) or retina caused by a very small embolus which briefly lodges in an artery and quickly dissolves. This causes transient stroke-like symptoms (speech arrest, facial droop, one-sided weakness, loss of vision in one eye).

Carotid Body Tumor

Carotid body tumors are rare, benign tumors that grow from cells of the carotid body, a baroreceptor (pressure receptor) found at the carotid bifurcation. The carotid body is normally involved in blood pressure regulation. Carotid body tumors are a type of paraganglioma, related to glomus jugulare tumors and adrenal pheochromocytomas, all rare.

Carotid body tumors usually present as a painless lump in the neck. They are treated with surgical removal, preceded by embolizations of the tumor.

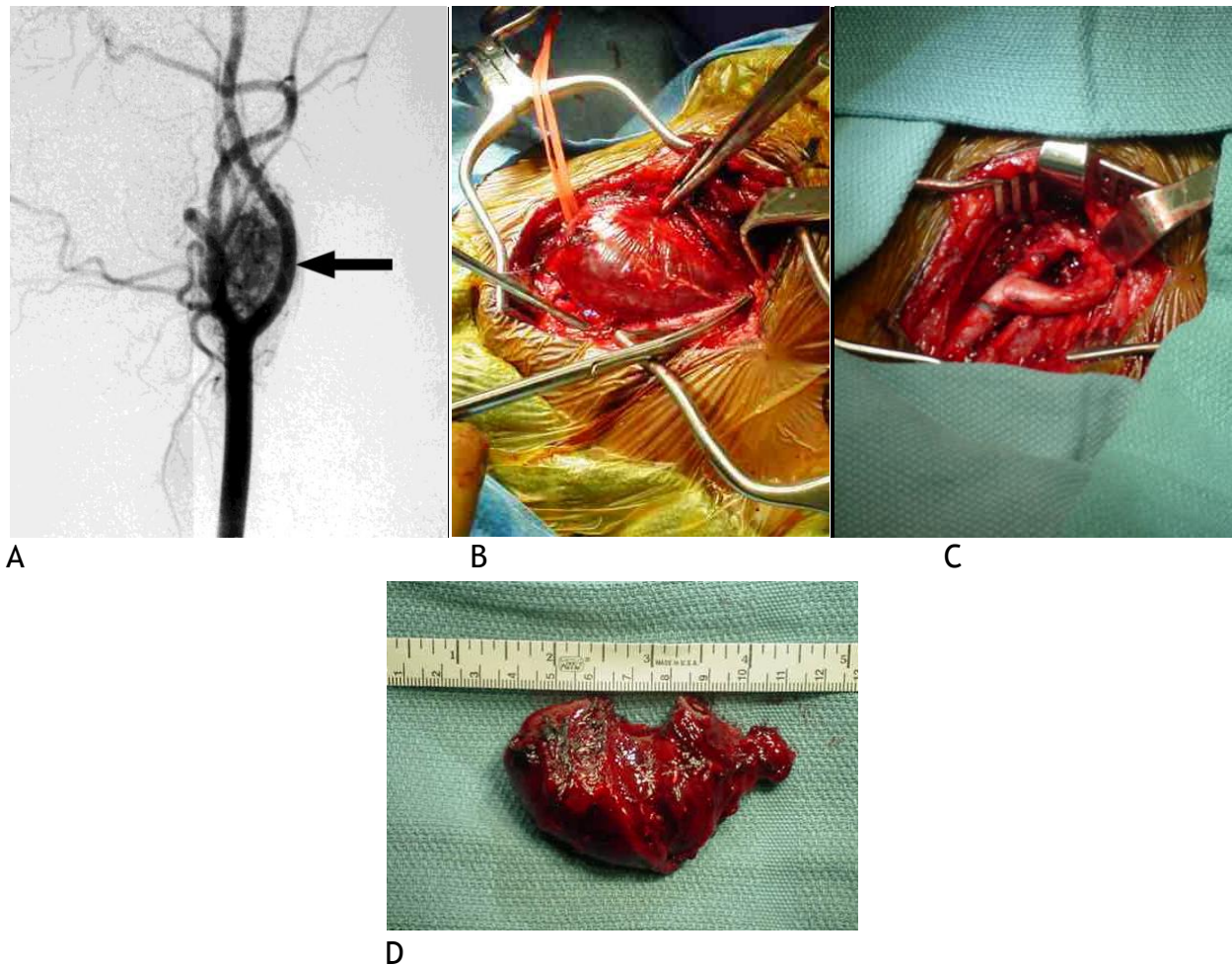


Figure 2: Carotid Body Tumor.

- A. Angiogram showing tumor blush (arrow) at the carotid bifurcation.
- B. Dissection of a large carotid body tumor.
- C. Carotid bifurcation after removal of the tumor.
- D. Tumor removed.

Cerebral Aneurysm

A **cerebral aneurysm** is a balloon-like outpouching of an artery of the brain (Figure 3). They typically occur at the bifurcations of the arteries of the base of the brain, i.e. the circle of Willis. Cerebral aneurysms sort of resemble berries, and may be called berry aneurysms.

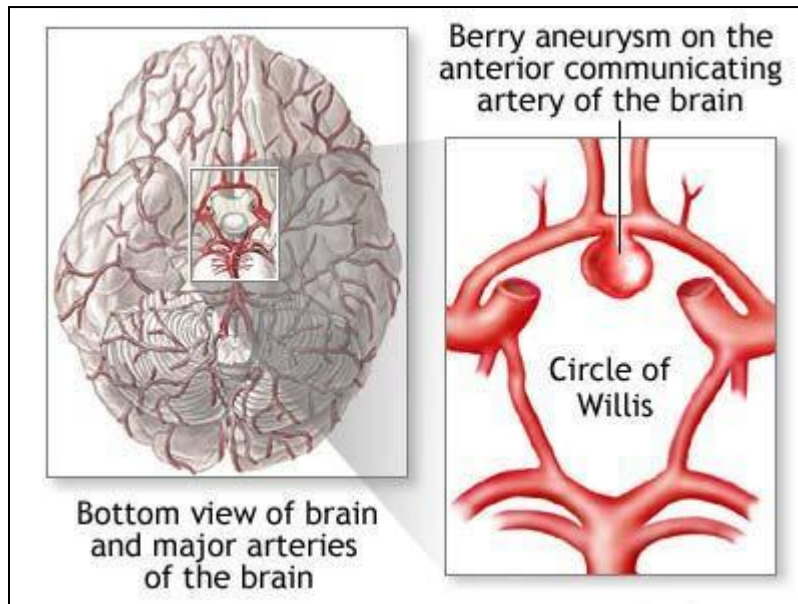
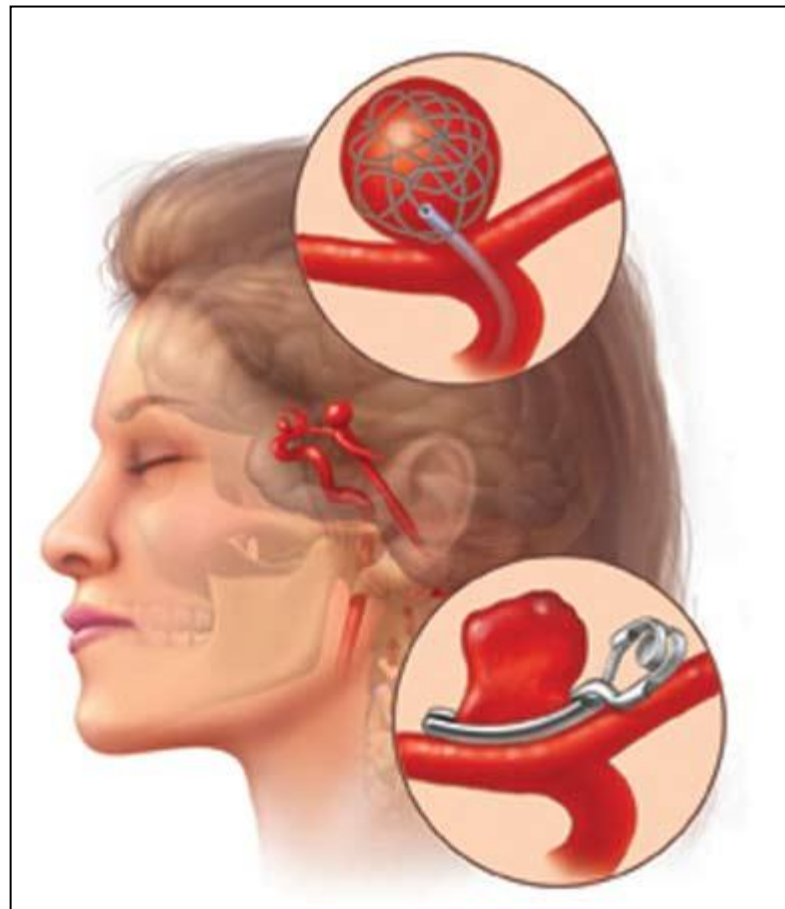


Figure 3: Drawing of Inferior View of the Brain Showing Circle of Willis and Cerebral Aneurysm

Cerebral aneurysms can rupture, causing hemorrhage within the subarachnoid space (subarachnoid hemorrhage). They can also hemorrhage into the brain itself and into the ventricles. About 50% of aneurysm ruptures are fatal. Of the remaining 50%, half of these end in good outcome, and half in poor outcome despite treatment.

Figure 4: Drawing depicting coiling (upper) and clipping (lower) of a cerebral aneurysm.

Treatment of cerebral aneurysms involves either surgical clipping or endovascular treatments such as coiling, stenting and/or use of a glue-like material (Figure 4). These treatments prevent the aneurysm from rupturing further. However the damage done by the original rupture cannot be reversed. Secondary problems stemming from aneurysm rupture include cerebral vasospasm and hydrocephalus, which are treated after securing the aneurysm.



Arteriovenous Malformation (AVM)

An **arteriovenous malformation**, or **AVM**, is a congenital (born with) abnormality of the brain (or spinal cord) characterized by a tangle (nidus) of arteries and veins (Figure 5). The nidus lacks the capillary network of normal tissues that separates the arterial side of the circulation from the venous side, such that there exists a high-flow shunt or fistula from the arterial to the venous side through the nidus.

Arteriovenous malformations can hemorrhage into the brain or ventricles, or they can harbor aneurysms on the feeding arteries which can rupture causing subarachnoid hemorrhage. Arteriovenous malformations can also cause seizures, headaches and other neurologic symptoms.

Treatment of large AVMs involves surgical removal, usually preceded by one or more embolizations of the feeding arteries. The embolizations are performed by an interventional neuroradiologist or a neurosurgeon, using coils, glues, gelfoam, silk and other embolic materials. Smaller AVMs are frequently treated with focused (stereotactic) radiation.

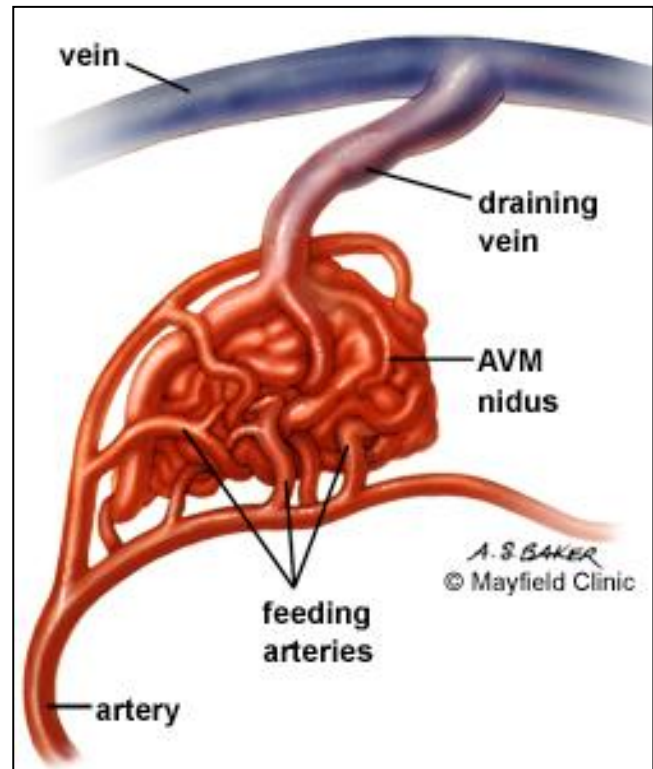


Figure 5: Drawing of a Brain AVM.

Cavernous Malformation

A **cavernous malformation** is an abnormality of blood vessels with multiple dilated chambers (caverns) with slowly flowing blood (Figure 6). They superficially resemble blackberries. Cavernous malformations can cause problems when one of the caverns dramatically expands, usually temporarily. They can also hemorrhage into the brain, and can cause seizures.

Figure 6: Post-mortem brain specimen showing a cavernous malformation.

