Arteriovenous Malformations of the Brain: History, Embryology, Pathological Considerations, and Hemodynamics

Abstract

Arteriovenous malformations (AVMs) of the brain are abnormal connections between arteries and veins that can lead to serious neurological complications, including hemorrhage, stroke, and seizures. AVMs are rare, occurring in only about 1 in 100,000 people, but they can be devastating for those who are affected.

The history of AVMs dates back to the early 19th century, when they were first described by the French physician Jean Cruveilhier. Since then, there has been a growing understanding of the embryology, pathology, and hemodynamics of AVMs. This article provides a comprehensive overview of AVMs, including their history, embryology, pathological considerations, and hemodynamics.

Microneurosurgery, Volume IIIB: AVM of the Brain, History, Embryology, Pathological Considerations, Hemodynamics, Diagnostic Studies, Microsurgical Anatomy by Melvin A. Shiffman

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History

The first description of an AVM was by the French physician Jean Cruveilhier in 1829. He described an AVM as a "congenital anomaly of the vascular system" that was characterized by a "direct communication between an artery and a vein." Cruveilhier also noted that AVMs could lead to a variety of neurological complications, including hemorrhage, stroke, and seizures.

In the years since Cruveilhier's first description, there has been a growing understanding of AVMs. In the early 20th century, several important advances were made in the diagnosis and treatment of AVMs. In 1932, the first successful surgical resection of an AVM was performed by the American neurosurgeon Harvey Cushing. In 1949, the first successful endovascular embolization of an AVM was performed by the American neuroradiologist Charles Dotter.

Today, AVMs are diagnosed and treated using a variety of techniques, including MRI, CT angiography, and endovascular embolization. The goal of treatment is to prevent hemorrhage and other neurological complications.

Embryology

AVMs are thought to be caused by a developmental abnormality in the formation of the brain's blood vessels. During embryonic development, the brain's arteries and veins develop from a network of primitive blood vessels called the capillary plexus. Normally, the capillary plexus differentiates into

a system of arteries and veins that are connected by capillaries. However, in some cases, the capillary plexus fails to differentiate properly, resulting in the formation of an AVM.

AVMs can occur anywhere in the brain, but they are most commonly located in the cerebrum and cerebellum. The size of AVMs can vary from a few millimeters to several centimeters. Small AVMs may not cause any symptoms, but larger AVMs can lead to a variety of neurological complications.

Pathological Considerations

AVMs are characterized by a direct connection between an artery and a vein. This connection is usually made through a nidus, which is a tangle of abnormal blood vessels. The nidus is typically supplied by one or more arteries and drains into one or more veins.

The pathology of AVMs can vary depending on the size and location of the AVM. Small AVMs may only cause a slight increase in blood flow, while larger AVMs can cause significant hemodynamic changes in the surrounding brain tissue.

The most common complication of AVMs is hemorrhage. Hemorrhage can occur when the AVM ruptures, causing blood to leak into the surrounding brain tissue. Hemorrhage can be a life-threatening condition, and it is the leading cause of death in patients with AVMs.

Other complications of AVMs include:

- Stroke

- Seizures
- Headaches
- Cognitive impairment
- Behavioral problems

Hemodynamics

The hemodynamics of AVMs is complex and can vary depending on the size and location of the AVM. In general, AVMs cause an increase in blood flow to the surrounding brain tissue. This increase in blood flow can lead to a variety of hemodynamic changes, including:

- Increased intracranial pressure
- Increased cerebral blood volume
- Increased cerebral blood flow
- Increased oxygen consumption
- Increased glucose consumption

These hemodynamic changes can have a significant impact on the function of the surrounding brain tissue. Increased intracranial pressure can lead to headaches, nausea, and vomiting. Increased cerebral blood volume can lead to edema, which can further increase intracranial pressure. Increased cerebral blood flow can lead to seizures and stroke. Increased oxygen consumption and glucose consumption can lead to neuronal damage and death.

AVMs are complex vascular anomalies that can lead to serious neurological complications. The history, embryology, pathological considerations, and hemodynamics of AVMs are all important factors to consider when making treatment decisions.

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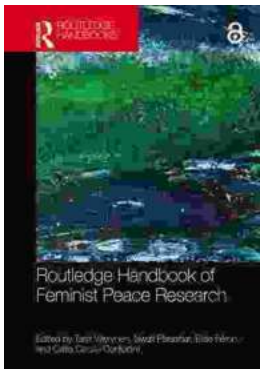

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