MED DEVICE ONLINE

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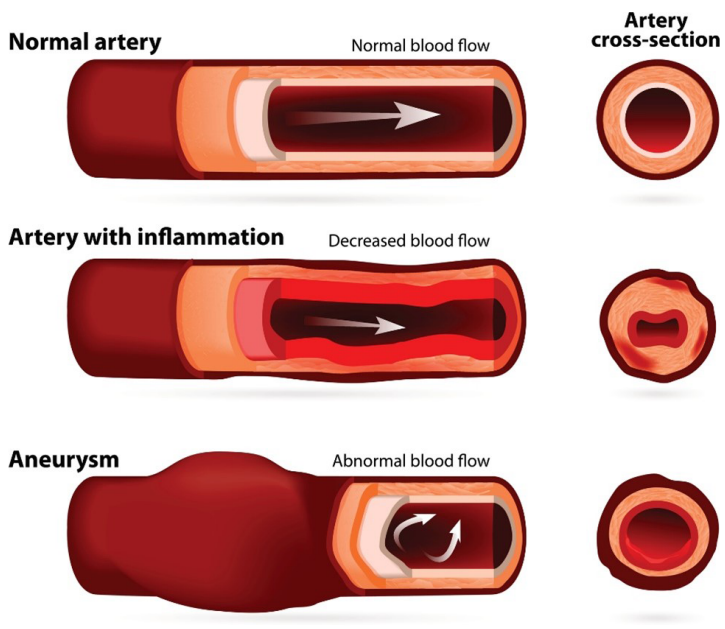
Embolization In The Treatment of Aneurysms

Source: DSM Biomedical

Aneurysms contribute to roughly 25,000 deaths in the United States each year and are typically defined as a weakening or bulging of an artery wall to greater than 50% of the vessel's normal diameter.[i] It is estimated that one to two percent of the population live with aneurysms, but only a small percentage of this group will experience a rupture.[ii] The three main types of aneurysms include abdominal aortic, thoracic aortic, and cerebral.

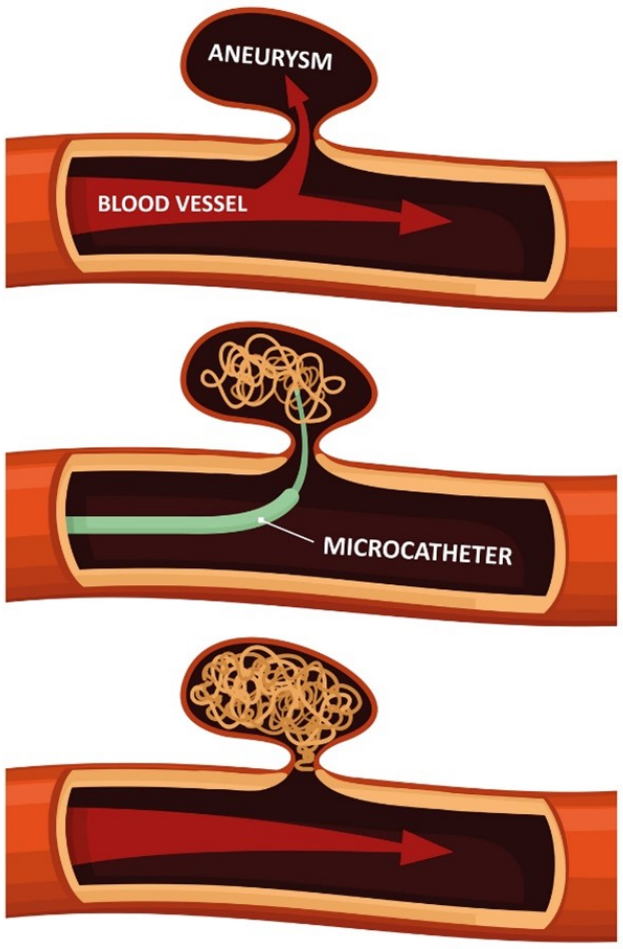


Abdominal aortic aneurysms, known as "triple A" or "AAA" are the most prevalent aortic aneurysms, occurring in the aorta's abdominal section below the diaphragm when a patient's blood pressure increases against the aorta's wall. This increase in pressure can cause a rupture of the aorta and often presents itself as back, abdominal, chest, or jaw pain. In many instances the pain associated with an abdominal aortic aneurysm be mistaken as a heart attack. Having a family history of abdominal aortic aneurysms is the most significant risk factor for this condition. Other risk factors include atherosclerosis, aorta infections, connective tissue disorders such as Marfan syndrome, and chronic high blood pressure.

Thoracic aortic aneurysms present in the portion of the aorta that passes through the chest. This includes the area where the aorta connects to the heart known as the aortic root, the ascending aorta near the heart, and the descending curved part of the aorta near the abdomen. Much like abdominal aortic aneurysms, thoracic aortic aneurysms present as a constant pain in the chest, jaw, or back and may also cause respiratory issues. A rapid heart rate can also be attributed to a thoracic aortic aneurysm. Risk factors for thoracic aortic aneurysms include having a family history, bicuspid aortic valve disease, atherosclerosis, or Marfan syndrome. Both abdominal and thoracic aneurysms develop slowly over many years and may not present themselves until they leak blood or are identified during routine imaging tests.

Cerebral aneurysms occur in blood vessels located in the brain which have bulged or ballooned out. These types of aneurysms can be present at birth or develop slowly during a patient's lifetime. It is estimated that one in fifty people have a cerebral aneurysm, however only a small number of these cases will present symptoms or fully rupture.[iii] When cerebral aneurysms do begin to leak a small amount of blood into the brain space symptoms may include loss of vision, severe headaches, and neck pain. A complete rupture of a cerebral aneurysm can present as seizures, nausea or vomiting, and loss of consciousness. Cerebral aneurysms can be diagnosed by CT or MRI imaging of the head or even an electrocardiogram in some instances.

Coil embolization is one treatment option for both aortic and cerebral aneurysms which involves a minimally invasive procedure aimed at filling the aneurysm with a coil like material to close off the aneurysm sac and reduce the risk of bleeding or rupture. This procedure is performed from within the artery using a steerable catheter inserted into the blood stream which is guided to the aneurysm target. The coils, typically made from platinum, stainless steel, or nitinol can vary in shape and size and can contain coatings. They are inserted into the aneurysm sac to promote clotting and closure of the aneurysm. Multiple coils are packed inside the aneurysm and remain within the aneurysm permanently, effectively stopping the blood flow into the aneurysm but allowing blood to flow freely through the normal artery. Coil embolization can be an effective treatment option for both ruptured and unruptured aneurysms.



While coil embolization has established itself as one of the leading treatments for aneurysms, there are inherent drawbacks. Nontargeted embolization and coil migration are two areas which could lead to prolonged recovery or revision surgery. Nontargeted embolization occurs when there is a coil misplacement in the aneurysm sac, or the selected coil size does not match the intended aneurysm vessel target. Thrombosis of the nontargeted vessel may occur if coils are too big for the aneurysm sac leading to coil extrusion into the outside vessel. Oversized coils can also elongate once delivered inside the aneurysm due to excessive force which could lead to an additional aneurysm rupture. It is estimated that up to 3% of patients experience migration of coils following a coil embolization procedure.[iv]

Recanalization is also a common complication associated with coil embolization. This typically occurs due to coil compaction, aneurysm regrowth, or unstable thrombus formation. The calculation between the anticipated aneurysm vessel volume and required coil volume plays a major roll in recanalization rates.

Given the array of aneurysm types and potential challenges associated with coil migration, embolization, and recanalization, new technologies and clinical approaches will be required to address current and future aneurysm needs. DSM biomedical offers a wide range of biomaterial solutions for use in arterial and venous embolization in the peripheral vasculature. DSM Biomedical has materials that can coat coils to alter their properties such as collagen and polyurethane. DSM also has materials in forms that can act as embolics such as collagen, absorbable synthetic polymer microspheres, as well as permanent materials such as thermoplastic and thermoset polyurethanes.

One specific example of a technology is a thermoset polyurethane plug made from DSM Biomedical's Biomerix™ technology platform. This device supports tissue ingrowth and provides durable occlusion of the target vascular site. Embolization with Biomerix™ polyurethane scaffold has also been proven to reduce acute time to occlusion when compared to traditional coil embolization while also demonstrating a robust safety profile[v] including long term biostability and biocompatibility[vi].

DSM Biomedical also provides innovative research and development grade solutions for neurological embolization. Biomerix polyurethane scaffold can be utilized as a "coil jacket" to provide a biointegrative solution aimed at reducing aneurysm recanalization rates.

About DSM Biomedical

DSM Biomedical is the world's unrivaled biomaterials expert and committed partner driving sustainable innovation in healthcare. For 30+ years, their solutions have been recognized for their unmatched quality, consistency and performance, ultimately supporting their company-wide vision of solving the world's healthcare needs through sustainable science.

To learn more, visit DSMBiomedical.com.

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[i] https://www.pennmedicine.org/updates/blogs/heart-and-vascular-blog/2018/june/types-of-aneurysms

[ii] https://www.mayoclinic.org/diseases-conditions/aneurysms/multimedia/aneurysm/vid-20462040

[iii] https://www.bafound.org/about-brain-aneurysms/brain-aneurysm-basics/brain-aneurysm-statistics-and-facts

[iv] Hu J, et al., Advances in Biomaterials and Technologies for Vascular Embolization. Advanced Materials 2019; 31(33): e1901071.

[v] Kipshidze N et. al. Evaluation of a novel endoluminal vascular occlusion device in a porcine model: early and late follow-up. J Endovasc Ther. 2005 Aug;12(4):486-94.

[vi] Data on file at DSM.