# Endovascular treatment of cerebral aneurysms

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**Abstract**

With the development of Guglielmi detachable coils in the 1990s, endovascular treatment of cerebral aneurysms became possible. The use of platinum coils demonstrated that endovascular repair was feasible, with procedure success rates comparable to traditional surgical techniques. However long-term clinical studies revealed several drawbacks with the first coil designs, primarily their lack of bioactivity and inability to consistently treat certain geometries of aneurysms. Polymer based coils and surface coatings have been developed to overcome these drawbacks, however they are not entirely successful. Recently more exotic expanding foam and liquid materials have been suggested to improve upon the original metallic coil design, though few *in vitro* studies have been conducted.

## 1. Introduction

An aneurysm is an abnormal blood-filled dilation of an artery. The exact causes of aneurysms are mostly unknown, but hypertension, genetic predisposition, and elastin disorders are known to increase risk. Once formed, eddies and pressure waves caused by irregular blood flow slowly increase the aneurysm size until rupture [1]. The vast majority of aneurysms occur either in the aorta or in the cerebral arteries. Aortic aneurysms are easily reached by surgical techniques, and are generally treated by replacing the affected artery section with a synthetic blood vessel. In the case of cerebral aneurysms surgery is dangerous, and in many cases impossible [2].

Approximately two million Americans have an unruptured cerebral aneurysm. The chance of a given aneurysm rupturing is greatly dependant on morphology, size, and location, but each year over 28,000 patients suffer a ruptured cerebral aneurysm in the United States [3]. While it may seem that there is little risk, death occurs in 50% of patients with a ruptured aneurysm, and the survivors have a 50% chance of neurological impairment [4].

Aneurysms are classified according to size and shape. Morphologically, aneurysms are either saccular or fusiform (Fig.1). Saccular aneurysms are further classified by their neck size, generally expressed as a ratio of neck diameter to sac diameter. Traditional treatment for saccular aneurysms involves clamping the aneurysm shut at the neck. Smaller neck sizes result in improved patient outcome in surgical clipping procedures. When possible, surgical clipping is an effective and permanent treatment for saccular cerebral aneurysms [7].

Fusiform morphologies vary greatly in shape and are unique to each patient. The complex geometry and larger amount of effected arterial surface area make treatment of fusiform aneurysm more difficult. If the blood vessel can be replaced with a synthetic material this often results in the best outcome. The affected vessel may also (depending on location) either be occluded by inducement of a thrombosis or bypassed with an artificial or natural graft. Where