# Ruptured Berry Aneurysms: Clip Or Coil?

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**Citation**

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**Abstract**

Aneurysmal rupture with subarachnoid haemorrhage is a significant cause of morbidity and mortality affecting about 6-12 persons in 100,000 per year. Traditionally, aneurysmal clipping has been employed to manage the condition, but recently endovascular coiling has enjoyed increasing popularity. Here we review these two modalities and assess the possible impact of The International Subarachnoid Aneurysm Trial (ISAT) on their use.

## INTRODUCTION

Current estimates show that approximately 2% of the Western population harbour an intracranial aneurysm [1]. Aneurysmal rupture with subarachnoid haemorrhage is a significant cause of morbidity and mortality in relatively young patients with an estimated annual incidence of 6-12 per 100,000 [2]. Once ruptured approximately about a third of patients will die within 24 hours of the bleed and a further third will succumb in the next month without some form of surgical intervention [3].

The primary goal of treatment of cerebral aneurysms is to prevent further rupture. Treatment traditionally relies on craniotomy and surgical clipping of the aneurysm at the neck to exclude it from the circulation. This approach offers an anatomical “cure” that is definitive and durable, and is not limited by aneurysm geometry. In addition, the procedure permits evacuation of significant intracerebral haematoma if indicated. However, the operation carries risks associated with brain retraction, cranial nerve manipulation, vessel occlusion and perforation. These risks can be compounded by limited access. A number of randomised trials by McKissock and colleagues [4,5,6] in the 1960s demonstrated that the benefits of this surgery outweighed the risks in certain conditions. Subsequent improvements in treatment have been achieved through advances in a number of different aspects of management including the introduction of the operating microscope, the development of better microsurgical techniques and instrumentation, improvements in peri-operative care, enhanced imaging techniques, and the emergence of vascular neurosurgery as a subspecialty [7,8,9].

In 1990, Guido Gugielmi [10] developed an alternative method for treating selected aneurysms that was introduced in Europe in 1992. The Gugielmi detachable coil (GDC) system consists of a soft and flexible microcoiled platinum wire that is delivered with a microcatheter placed into the aneurysm. Once properly positioned within the aneurysm, the coil is detached from the delivery wire using an electrolytic detachment process. The aim of treatment is to prevent blood flow into the aneurysm by filling it with coils and thrombus.

There are several possible advantages of GDC over conventional surgery. First, these procedures are performed utilising the same transfemoral approaches used in diagnostic angiography, potentially allowing treatment to be combined with the initial diagnostic cerebral angiogram and reducing the period of risk of re-rupture. Second, as the endovascular technique is “minimally invasive” it permits occlusion of aneurysms without the need for craniotomy and preventing brain or cranial nerve manipulation. This may result in shorter hospital stay and faster recovery. Third, it can be combined to treat multiple aneurysms in a single procedure or to utilise treatment with other endovascular therapies such as vasospasm (intra-arterial papaverine or angioplasty). Finally, since the approach is endovascular the situations that make a particular location straightforward or difficult are entirely different. Therefore there are some locations that are relatively difficult for surgery (such as basilar tip aneurysms) that are relatively straightforward for GDC. (Of course, the reverse is true for some sites such as the middle cerebral artery aneurysms.)

Despite these potential advantages there remain several drawbacks to endovascular techniques. Application of coils

is highly dependent on aneurysm morphology. This leads to a higher incidence of incomplete aneurysm occlusion. Also, there is a greater potential of aneurysm recurrence and rebleeding [8,9].

## THE INTERNATIONAL SUBARACHNOID ANEURYSM TRIAL (ISAT)

Several trials have attempted to quantitatively assess the different risks and benefits of open surgical versus endovascular approaches. The largest of these, called the International Subarachnoid Aneurysm Trial (ISAT), involved 2,143 patients with ruptured intracranial aneurysms that clinicians determined were equally suitable to either treatment. Patients were randomised to either neurosurgical clipping (1070) or endovascular treatment with platinum coils (1073). Disability was assessed using the modified Rankin scale.

The endovascular coil procedure significantly reduced the risk of dependency or death after one year compared to surgical clipping. The study was so strongly in favour of endovascular therapy that the trials ethics committee terminated it early. However, at the time of the first report in 2002 [8] the 1-year follow-up data was available for only 1594 of the 2143 patients enrolled and long-term follow up was not available. In a September 2005 article in the Lancet [9], the researchers report the complete 1-year data and results of long-term follow-up. Andrew Molyneux, Richard Kerr and colleagues recruited the patients from 42 neurosurgical centres in Europe, North America, and Australia. The researchers found that 250 of 1063 (23.5%) patients allocated to endovascular coiling were dead or dependent at one year compared with 326 of 1055 (30.9%) patients allocated to neurosurgery and clipping. The researchers found that this advantage was maintained up to 7 years after treatment. They also found that the risk of late re-bleeding was low but more common after coiling than after neurosurgical clipping. Patients assigned endovascular coiling also had a significantly lower risk of seizures than patients allocated to clipping.

## LIMITS OF THE TRIAL

The criticisms of the ISAT fall into several categories. They include study site selection, patient selection and the definition of clinical equipoise, relative expertise of the surgeons and interventionists, and the duration and type of follow-up. While some of the criticisms of ISAT reflect unavoidable statistical, design and temporal constraints and thus are of little significance, others are more important and include the need for clinical equipoise, and how that was defined across centres. Clearly different centres and clinicians may have different views on which patients are suitable for both surgical or endovascular repair. Indeed, over 7000 patients were not randomised in the trial and patients showed a skewed distribution of aneurysms. The authors have responded to this criticism [9,11] by suggesting that the variation is a strength of ISAT rather than a fault as it accommodates the breadth of professional opinion.

A second criticism is that the study does not address surgical expertise when comparing the two procedures. The authors counter this point [9,11] by stating the difficulty in objectively and reliably demonstrating that one neurosurgeon's results are substantially better than another's. The problems with attempts at such comparisons include the relatively small number of cases of aneurysm repair for individual neurosurgeons, the varied case mix, and the objectivity of the collection of outcome data.

A further criticism of the trials regards the need for long-term outcome data. Although the most recent trials demonstrate survival advantages up to seven-year after repair, further follow-up is necessary to ensure this survival benefit persists. The ISAT trial is funded to continue follow-up until 2007. In addition, investigations into the neuropsychological outcomes following the two procedures are underway.

Despite these criticisms the study satisfied all the major requirements of large trials and has demonstrated that when both open and endovascular repair are considered suitable the latter may be associated with reduced morbidity and mortality, and that this reduction in risk probably persists in the years following repair. It is, however, worth recalling that this study focuses on aneurysms that are equally suitable to both clipping and coiling (approximately half of all ruptured aneurysms). Many aneurysms are not currently considered morphologically appropriate for coiling and thus are not affected by the trials finding. In addition, the study is limited to ruptured aneurysms. Further investigation is necessary to determine when treatment is indicated in unruptured aneurysms, and which treatment is most suitable.

In conclusion, each patient and their aneurysm is different and the decision over whether to clip or coil has to be made about what is in the best interest for each patient. The ultimate decision is complex, involving many different factors relating to the nature of the aneurysm, the physical state of the patient, the availability and expertise of

neurosurgeons, and the patients own preferences to ensure the most appropriate care.

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