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Detachable coil embolisation of ruptured intracranial aneurysms: A single center study, a decade experience

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ABSTRACT

Objective: The introduction of detachable coils revolutionised the management of patients with intracranial aneurysms and is now considered a first-line treatment in our institution. The purpose of this study was to review 10 years of experience with this method.
Methods: A retrospective review of prospectively collected data on 711 patients undergoing endovascular treatment of ruptured intracranial aneurysm between 1996 and 2005 with regard to technical feasibility, procedural complications, rebleeding, anatomical outcome, need for retreatment and overall clinical outcome.
Results: Endovascular treatment failed in 25 aneurysms from a total of 717 (4%). Aneurysm rupture complicated 37 procedures (4.7%) leaving 10 patients permanently disabled or dead (1.3%). Thromboembolic events complicated 35 procedures (4.5%) leaving 8 patients permanently disabled or dead (1%). One other patient died because of fatal parent vessel rupture. Further 6 procedures were complicated by arterial dissection and 18 by coil loop protrusion, however all of these patients achieved independent recovery. Overall morbidity–mortality was 2.9%. Further subarachnoid heamorrhage occurred in 16 patients (2.3%), 12 of which died. Altogether, 121 aneurysms from 511 (24%) were recanalized on follow up angiography, 52 required retreatment (7.1%). At 6 months follow up, 580 patients (82%) were independent, while 130 patients (18%) were disabled or dead.
Conclusion: Detachable coil embolisation of intracranial aneurysms is a very feasible treatment method associated with a small risk of permanent morbidity–mortality. Risk of further bleeding is small, but related with devastating outcome. Approximately 25% of aneurysms will recanalize and 7% will require retreatment. Despite these shortcomings, vast majority of patients will achieve independent recovery.

1. Introduction

The introduction of controllable, retrievable, electrolytically detachable coils in 1990 [1,2] revolutionised the management of patients with intracranial aneurysms. Initially, those aneurysms considered too risky for neurosurgery were treated using coils, but gradually the previously narrow criteria for endovascular therapy became wider and their therapeutic efficacy was eventually proven by the International Subarachnoid Aneurysm Trial (ISAT) [3,4]. Although level one evidence is provided by this study, single centre large series can also give useful information concerning treatment complications and their outcomes as well as long-term anatomical results. We reviewed the experience of 10 years of endovascular coil occlusion of ruptured intracranial aneurysms from a single centre. The main points of our study were technical feasibility, treatment complications, rebleeding, overall clinical outcome and anatomical results including the need for repeated treatment.

2. Patients and methods

2.1. Patient population

This is a retrospective observational study of 711 patients referred to Frenchay Hospital, Bristol, United Kingdom, for treatment of subarachnoid haemorrhage (SAH) due to ruptured berry aneurysms. All patients underwent primary endovascular coiling over a 10-year period between January 1996 and December 2005. Patients with fusiform or dissecting aneurysms (9 patients) and those treated with primary parent vessel occlusion (5 patients) were excluded. Patient information, aneurysm characteristics,

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Table 1
Clinical grade of patients prior to treatment according to the World Federation of Neurosurgical Societies (WFNS) scale [5].

WFNS grade	Number of patients	Percentage of total
I	438	62
II	117	16
III	37	5
IV	84	12
V	35	5

Table 2
Time from ictus to endovascular treatment.

Time to treatment (days)	Number of patients	Percentage of total
0–2	388	55
3–7	204	29
8–14	64	9
15–30	31	4
Over 30	24	3

details of treatment and clinical course were entered prospectively into a database and subsequently analysed.

Of the 711 patients, 459 (65%) were women and 252 (35%) were men. The mean age was 53 years (median 53 years, range 16–85 years). Clinical condition was assessed just prior to treatment using the World Federation of Neurosurgical Societies (WFNS) grading scale [5]. Altogether, 438 patients were grade I (62%), 117 were grade II (16%), 37 were grade III (5%), 84 were grade IV (12%) and 35 were grade V (5%) (Table 1). Patients of poor clinical grade without reasonable chance of survival at presentation were treated conservatively and are not included in this study. During the study period additional 344 patients underwent microsurgical clipping of their ruptured aneurysm (Fig. 1).

2.2. Decision to treat

In the early years, the decision to opt for endovascular treatment over clipping was based on associated medical co-morbidity and anticipated surgical difficulties. Over time endovascular coiling became the preferred method of treatment in our institution, a decision that was later supported by the results of the ISAT trial [3,4]. This is reflected in yearly increase in the number of endovascular procedures performed, increasing from 22 in 1995 to 120 in 2005 (Fig. 1). Presently, approximately 95% of ruptured aneurysms are treated endovascularly in our institute. All procedures were performed by a board certified neuroradiologist (SAR, AJM) with a minimum of 3.5 years of experience of coil embolisation at the start of the study period. Patients were treated as soon as practicable after the initial ictus, however due to late referral some patients did not receive treatment until later in the course of disease. Once admitted to our institute, patients were usually treated the same day. Overall, 388 patients (55%) were treated within 2 days of their original SAH, 204 (29%) were treated between days 3 and 7 and 64 (9%) were treated during the second week after the ictus (Table 2). The remaining 55 patients (7%) were treated later. When necessary, an external ventricular or lumbar drain was inserted to relieve early hydrocephalus.

2.3. The endovascular procedure

Endovascular coiling was performed using conventional techniques. Patients were treated under general anaesthesia. A bolus of intravenous heparin was followed by continuous infusion via the catheter flushing system at a concentration of 5 i.u./ml. The aim was to place coils sequentially into the aneurysm sac to the point of angiographic occlusion. The vast majority of coils deployed were bare platinum; either Guglielmi Detachable Coils (Boston Scientific, Freemont, CA) or Micrus (Micrus corporation, San Jose, CA), however a small number of coated bioactive coils, Matrix (Boston Scientific, Freemont, CA) and Cerecyte (Micrus, San Jose, CA) were also used. Following diagnostic angiography the aneurysm was selectively catheterised with a microcatheter using standard techniques, through a guiding catheter placed in the appropriate cervical carotid artery or vertebral artery. The procedure of routine coil embolisation is well described and where necessary, balloon remodelling or stent-assisted coil embolisation was employed for the treatment of wide-necked aneurysms. Technical failure was defined as an attempted embolisation procedure during which no coils were detached. Any procedural or other subsequent complication was recorded as well as any change in patients' neurological status after the procedure.

2.4. Aneurysms treated

A total of 780 aneurysms were treated in these 711 patients. The aneurysm responsible for the bleeding was identified by blood distribution on computer tomography (CT), aneurysm appearance and vasospasm distribution. This aneurysm was treated first; the additional aneurysms were either treated during the same

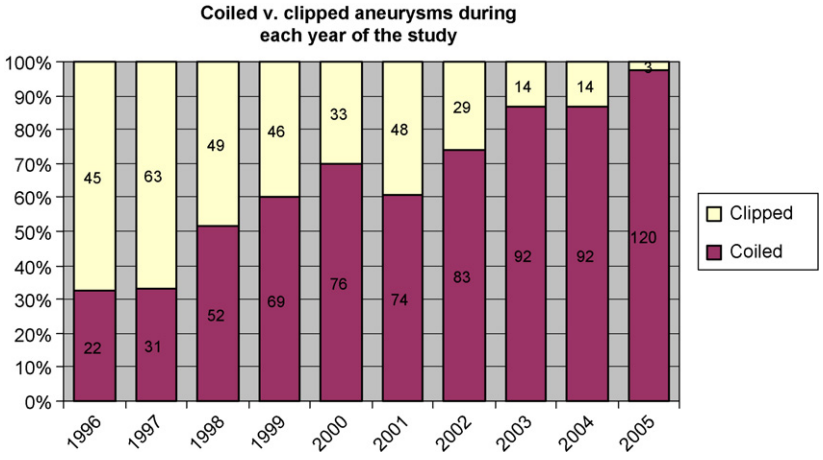

Fig. 1. Number of patients who underwent coiling or clipping of ruptured berry aneurysm in each year of the study.