Journal of Clinical Neuroscience 19 (2012) 1115–1118

Contents lists available at SciVerse ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Clinical Study

The impact of microsurgical clipping and endovascular coiling on the outcome of cerebral aneurysms in patients over 60 years of age

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ARTICLE INFO

Article history:
Received 1 August 2011
Accepted 10 November 2011

Keywords:
Cerebral aneurysms
Endovascular coiling
Microsurgical clipping
Outcome
Safety

ABSTRACT

A retrospective study was performed to compare the safety and efficacy in elderly patients of endovascular coiling, with clipping, for cerebral aneurysms. In total, 198 patients over 60 years of age with ruptured intracranial aneurysms were treated by microsurgical clipping ($n = 122$) or endovascular coiling ($n = 76$). Endovascular coiling achieved favorable outcome in 88.2% of patients, which was significantly higher than for the microsurgical clipping group. The occurrence of re-bleeding, infarction, and hydrocephalus was similar between the two groups. Intraoperative time for microsurgical clipping was significantly longer than that for endovascular coiling. Length of hospitalization was shorter for the coiling group than for the clipping group. Our results suggest that endovascular coiling should be considered as the first-choice therapy in elderly patients with ruptured aneurysms, as it may reduce duration of both the operation and hospitalization.

1. Introduction

Ruptured intracranial aneurysm is the most common cause of subarachnoid hemorrhage (SAH), and can lead to significant morbidity and mortality.[1–3] In Western populations, the annual incidence of SAH has been reported as 10–15 per 100,000 persons.[4] Clinically, a ruptured aneurysm is detected by radiologic imaging in 80% of patients with SAH.[5] After SAH due to rupture of an intracranial aneurysm, the risk of re-rupture is high. Treatment is necessary to avoid re-rupture and the risk of other secondary complications. The most common methods for treating intracranial aneurysm are surgical clipping and endovascular embolization with detachable coils.[6,7]

The International Subarachnoid Aneurysm Trial (ISAT) compared these techniques in randomized patients who had suffered recent intracranial aneurysm rupture.[8,9] At the one-year follow-up, death or disability occurred less frequently among those treated with coil embolization. While the ISAT findings have led to increased use of coil embolization, very limited information exists on the long-term efficacy of coils in reducing the risk of re-bleeding.[10–12] The Cerebral Aneurysm Re-rupture After Treatment (CARAT) study was designed to directly compare re-rupture rates after SAH in patients treated initially with coil embolization or surgical clipping.[13] Re-rupture of aneurysms treated by either coil embolization or surgical clipping was rare after the first year. Late re-treatment was more common after coil embolization than after clipping, but complication rates were low.

The relative benefits of these two approaches have yet to be established, especially in elderly patients. This particular group has a high prevalence of co-morbidities in cardiac, cerebrovascular and lung function, and, consequently, poor tolerance of invasive interventions. We performed a retrospective study to compare the safety and efficacy of endovascular coiling with standard neurosurgical clipping for treating cerebral aneurysms in elderly patients.

2. Methods

2.1. Participants

A total of 198 elderly patients with ruptured intracranial aneurysms were treated by microsurgical clipping or endovascular coiling in our hospital from January 2005 to December 2009. Patients were eligible for the study if they: (i) were more that 60 years old; (ii) had a definite SAH, as shown on CT scan or lumbar puncture; and (iii) had an intracranial aneurysm, demonstrated by intra-arterial or CT angiography, which was considered responsible for the recent SAH. Three patients were excluded due to incomplete clinical information. The study was approved by the ethics committee in our hospital.

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http://dx.doi.org/10.1016/j.jocn.2011.11.017

2.2. Classification and clinical outcome

All eligible patients were placed in the microsurgical clipping group or the endovascular coiling group. The Hunt and Hess grades were evaluated at admission. The duration of the operation was recorded in minutes. The duration of hospitalization after surgical intervention was recorded in days.

Treatment-related complications were evaluated and recorded, including intra- or postoperative re-bleeding of the aneurysm, hydrocephalus, brain infarction, epilepsy, cranial nerve palsy, cognitive impairment, upper gastrointestinal hemorrhage, neurogenic pulmonary edema, and infection.

Short-term clinical outcome at the time of discharge was assessed for each patient from the medical record by a single independent clinician using the Glasgow Outcome Scale (GOS) score. Clinical outcome was defined according to the GOS score: favorable outcome (good recovery, GOS 5; moderate disability, GOS 4) or poor outcome (severe disability, GOS 2–3; death, GOS 1).

Long-term clinical outcome was determined in all surviving patients by clinical follow-up at six months to three years (mean of 19 months) conducted in our outpatients clinic or by telephone. GOS scores were also re-estimated at follow-up. Radiological imaging (brain CT scan or MRI) was performed six months after discharge to determine recurrent events of hemorrhage, infarction, or hydrocephalus. To investigate the treated aneurysm, digital subtracted angiography (DSA) was performed at six months to two years after discharge (mean, nine months).

2.3. Statistical methods

All analysis was performed using Statistical Package for the Social Sciences version 10.0 (SPSS; Chicago, IL, USA). Data from normally distributed parameters were summarized as mean ± standard deviation (SD). The Student's *t*-test and chi-squared (χ^2) test were performed for univariate analysis. Multiple logistic regression analysis was performed to determine the predictors of good outcome.

3. Results

Microsurgical clipping was performed in 122 patients, while the remaining 76 patients received endovascular coiling treatment. The demographic features of these two groups of patients (Table 1) were similar in terms of age, gender, vascular risk factors, and Hunt and Hess grading. Table 2 shows the location of the aneurysms, the prevalence of which was similar between the two groups.

Table 3 shows the comparison between microsurgical clipping and endovascular coiling in terms of duration of operation, complications, days of hospitalization required, and short-term outcome. The intraoperative time needed to complete microsurgical clipping (193.5 ± 12.3 minutes) was significantly longer than that for endovascular coiling (56.4 ± 7.1 minutes) ($p < 0.05$). The post-operative duration of hospitalization required for the endovascular coiling group (13.8 ± 5.7 days) was shorter than that for the microsurgical clipping group (20.3 ± 6.9 days) ($p < 0.05$).

The occurrence of treatment-related complications was also compared between the two groups, and included intra-operative or post-operative re-bleeding of the aneurysm, hydrocephalus, brain infarction, epilepsy, cranial nerve palsy, cognitive impairment, upper gastrointestinal hemorrhage, neurogenic pulmonary edema, and infection. Univariate analysis showed similar prevalence in the two groups for all complications.

Table 1
Characteristics of patients older than 60 years of age who underwent microsurgical clipping or endovascular coiling for a ruptured aneurysm

	Microsurgical clipping (*n* = 122)	Endovascular coiling (*n* = 76)	*p*-value
Gender, male/female	33/89	27/49	>0.05
Age, mean ± SD	52.8 ± 10.4	51.7 ± 13.0	>0.05
Diabetes	18	14	>0.05
Hypertension	57	35	>0.05
Hyperlipidemia	50	29	>0.05
Coronary artery disease	27	20	>0.05
Hunt and Hess grade			
I	29	12	>0.05
II	58	41	>0.05
III	20	11	>0.05
IV	14	12	>0.05
V	1	0	>0.05

SD = standard deviation.

Table 2
Locations of the aneurysms in patients older than 60 years of age who underwent microsurgical clipping or endovascular coiling for a ruptured aneurysm

Location (no.)	Microsurgical clipping (*n* = 122)	Endovascular coiling (*n* = 76)	*p*-value
Anterior communicating artery (52)	35	17	>0.05
Anterior cerebral artery (7)	4	3	>0.05
Middle cerebral artery (21)	15	6	>0.05
Posterior communicating artery (79)	46	33	>0.05
Anterior choroidal artery (3)	2	1	>0.05
Ophthalmic artery (16)	8	8	>0.05
Superior hypophyseal artery (3)	2	1	>0.05
Internal carotid artery (4)	4	0	>0.05
Vertebral artery (7)	2	5	>0.05
Posterior cerebral artery (2)	2	0	>0.05
Anterior inferior cerebellar artery(3)	1	2	>0.05
Posterior inferior cerebellar artery(1)	1	0	>0.05

Table 3
Intraoperative and postoperative features of patients older than 60 years of age who underwent microsurgical clipping or endovascular coiling for a ruptured aneurysm

	Microsurgical clipping (*n* = 122)	Endovascular coiling (*n* = 76)	*p*-Value
Time needed for operation (± SD, minutes)	193.5 ± 12.3	56.4 ± 7.1	<0.05
Duration of stay in ICU (± SD, hours)	36.5 ± 6.2	13.2 ± 4.8	<0.05
Duration in hospital (± SD, days)	20.3 ± 6.9	13.8 ± 5.7	<0.05
Re-bleeding of aneurysm during operation, *n* (%)	7 (5.7)	3 (3.9)	>0.05
Re-bleeding of aneurysm after operation, *n* (%)	2 (1.6)	2 (2.6)	>0.05
Brain infarction, *n* (%)	9 (7.4)	3 (3.9)	>0.05
Brain hydrocephaly requiring a shunt, *n* (%)	5 (4)	3 (3.9)	>0.05
Epilepsy, *n* (%)	2 (1.6)	0	>0.05
Cranial nerve paralysis, *n* (%)	7 (5.7)	3 (3.9)	>0.05
Decreased sight, *n* (%)	2 (1.6)	0	>0.05
Aphasia, *n* (%)	1 (0.8)	1 (1.3)	>0.05
Cognitive impairment, *n* (%)	5 (4)	2 (2.6)	>0.05
Hypothalamus disorder, *n* (%)	2 (1.6)	1 (1.3)	>0.05
Infection, intracranial or pulmonary, *n* (%)	10 (8.2)	2 (2.6)	>0.05
Upper gastrointestinal hemorrhage, *n* (%)	2 (1.6)	1 (1.3)	>0.05
Neurogenic pulmonary edema, *n* (%)	2 (1.6)	1 (1.3)	>0.05
Favorable outcome at discharge, GOS score of 4–5	86	67	<0.01

GOS = Glasgow Outcome Scale, ICU = Intensive Care Unit, SD = standard deviation.