SHORT REPORT

Endovascular coiling versus neurosurgical clipping in patients with a ruptured basilar tip aneurysm

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Objectives: To compare endovascular coiling with neurosurgical clipping of ruptured basilar bifurcation aneurysms.
Methods: Patient and aneurysm characteristics, procedural complications, and clinical and anatomical results were compared retrospectively in 44 coiled patients and 44 patients treated by clipping. The odds ratios for poor outcome (Glasgow outcome scale 1, 2, 3) adjusted for age, clinical condition, and aneurysm size were assessed by logistic regression analysis.
Results: In the endovascular group, five patients (11%) had a poor outcome *v* 13 (30%) in the surgical group; the adjusted odds ratio for poor outcome after coiling *v* clipping was 0.28 (95% confidence interval, 0.08 to 0.99). Procedural complications were more common in the surgical group. Optimal or suboptimal occlusion of the aneurysm immediately after coiling was achieved in 41 patients (93%). Clipping was successful in 40 patients (91%).
Conclusions: The results suggest that embolisation with coils is the preferred treatment for patients with ruptured basilar bifurcation aneurysms.

Neurosurgical clipping used to be the standard treatment for ruptured intracranial aneurysms. Results are poor compared with non-basilar aneurysms,[1 2] probably because of the proximity of perforating brain stem vessels and the small working space.[3 4]

Treatment with Guglielmi detachable coils[5] has gained widespread acceptance, in particular for posterior circulation aneurysms. In a meta-analysis of observational studies, procedure related mortality from coiling of basilar bifurcation aneurysms was 0.9% and the rate of permanent complications was 5.4%.[6] In a more recent study of 112 ruptured posterior circulation aneurysms, combined mortality and morbidity was 3.7%, and 94% of aneurysms were treated successfully.[7] These results compare favourably with those of clipping, but controlled studies are lacking.

METHODS

We selected all patients with a ruptured basilar bifurcation aneurysm who were treated by coiling in the St Elisabeth Hospital Tilburg between 1994 and 1999, or by clipping in St Elisabeth Hospital between 1983 and 1993 or in the University Medical Centre Utrecht between 1983 and 1999.

We collected data retrospectively on: age, aneurysm size (small (≤ 10 mm), large (11–25 mm), or giant (> 25 mm)), clinical condition before treatment (good (World Federation of Neurosurgical Societies (WFNS) score I–III) *v* poor (WFNS IV–V)), time interval between subarachnoid haemorrhage and treatment, amount of blood on computed tomography (CT), procedural and postprocedural complications, successfulness of aneurysm obliteration, and clinical outcome assessed by a neurologist or neuroradiologist in case of coiled patients; in neurosurgical patients follow up was undertaken by the neurosurgeon involved. We categorised the amount of blood leakage as small, moderate, or substantial instead of using established scores, because of poor quality of several of the CT scans.

Complications such as rebleeding (including aneurysm perforation during either of the treatments) or cerebral ischaemia were diagnosed clinically (new focal signs and/or a decline in the level of consciousness) and by imaging (CT). Ischaemia was diagnosed after excluding other causes by CT scanning and metabolic screening. After coiling and on a follow up angiogram at six months we classified the degree of aneurysm occlusion as optimal, suboptimal, (small neck remnant or "dog ear"), or partial (if a larger part remained visible). Operation was considered successful if the aneurysm was clipped. Outcome was classified using the Glasgow outcome scale (GOS): independence in activities of daily living (GOS 4 or 5), dependence (GOS 2 or 3), or death (GOS 1) and assessed at follow up in the outpatient clinic or at angiographic follow up. Causes of poor outcome were assessed.

Data analysis

We calculated the proportion of patients with poor outcome (GOS 1, 2, 3) after coiling or clipping and the corresponding 95% confidence interval. With logistic regression analyses we assessed the odds ratio for poor outcome after coiling versus clipping, adjusting for age, clinical condition before treatment, and aneurysm size. We recalculated the adjusted odds ratios in patients treated early (< 21days after subarachnoid haemorrhage)[8] and compared the outcome in surgically treated patients clipped before and after 1994.

RESULTS

Table 1 shows the baseline characteristics, complications, and results in the two patient groups.

Clinical outcome

Median follow up in the endovascular group was 4.0 months (range 2.0 to 19) and in the surgical group, 3.5 months (range 1.5 to 18). Five endovascularly treated patients (11.4%; 95% confidence interval 3.8% to 24.6%) had a poor outcome, compared with 13 surgical patients (29.5%; 16.8% to 34.9%). The crude odds ratio for poor outcome after coiling versus clipping was 0.31 (0.10 to 0.95); after adjustment for age, clinical condition before treatment, and aneurysm size the odds ratio was 0.28 (0.08 to 0.99). In the subset group of patients treated early (< 21 days), the odds ratio for coiling *v* clipping was essentially the same as for the whole group.

Complications

The percentages of procedural complications (during or within 24 hours after treatment), of both aneurysmal

Table 1 Patient characteristics and results

		Embolisation with coils (n=44)	Neurosurgical clipping (n=44)
Female sex (n (%))		29 (66%)	26 (59%)
Age (years) (mean)		47.0	44.2
Time interval between SAH and first treatment (days) (median, range)		16 (1 to 120)	13 (1 to 70)
Clinical condition before treatment (n (%))	WFNS I–III	41 (93)	43 (98)
	WFNS IV–V	3 (7)	1 (2)
Amount of blood on CT scan (n (%))	Small	14 (32)	12 (27)
	Moderate	10 (23)	3 (7)
	Substantial	15 (34)	24 (55)
	Unknown	5 (11)	5 (11)
Aneurysm size (n (%))	0–10 mm	23 (52)	16 (36)
	11–25 mm	17 (39)	25 (57)
	>25 mm	4 (9)	3 (7)
Complications (n (%))			
Haemorrhage during treatment	All	3 (7)	6 (14)
	Without permanent neurological deficit	1 (2)	2 (5)
	With permanent neurological deficit	1 (2)	1 (2)
	Resulting in death	1 (2)	2 (5)
Ischaemia during treatment	All	–	12 (27)
	Without permanent neurological deficit	–	4 (9)
	With permanent neurological deficit	–	6 (14)
	Resulting in death	–	2 (5)*
Recurrent haemorrhage after treatment	All	1 (2)	1 (2)
	Without permanent neurological deficit	–	–
	With permanent neurological deficit	–	–
	Resulting in death	1 (2)	1 (2)
Ischaemia after treatment	All	2 (5)	3 (7)
	Without permanent neurological deficit	–	1 (2)
	With permanent neurological deficit	2 (5)	2 (5)
	Resulting in death	–	–
Clinical outcome	GOS score (n (%))		
	I (death)	2 (4)	5 (11)
	II-III (functionally dependent)	3 (7)	8 (18)
	IV-V (functionally independent	39 (89)	31 (71)

*One patient also had a haemorrhage during treatment. CT, computed tomography; GOS, Glasgow outcome scale; SAH, subarachnoid haemorrhage; WFNS, World Federation of Neurosurgical Societies score.

haemorrhage and cerebral ischaemia, were higher in the surgical group, but this difference was not statistically significant. The risks of recurrent haemorrhage or ischaemia were comparable.

Causes of poor outcome

Causes of poor outcome after coiling were: procedural aneurysmal rupture in one patient, recurrent haemorrhage three months after partial aneurysm occlusion in a second, and poor clinical condition before treatment in three others.

Poor outcome after surgery was caused by peroperative rupture of the aneurysm in two patients, procedural ischaemia in seven, postoperative ischaemia in two, postoperative recurrent haemorrhage in one, and hydrocephalus in one.

Anatomical results

Coiling was unsuccessful initially in six patients, but a second procedure succeeded in all. The degree of aneurysm occlusion immediately after coiling was optimal in 32 patients (73%), suboptimal in nine (20%), and partial in three (7%). Control angiography after six months in 39 patients showed optimal occlusion in 25 patients (64%), suboptimal in nine (23%), and partial occlusion in five (13%). Twenty six patients had a second control angiography after a median interval of 23 months. No compaction of coils or regrowth of the aneurysm was seen.

In the surgical group, clipping succeeded in 40 patients (91%), but was not feasible in four patients (one giant and three large aneurysms).

DISCUSSION

Patients with a ruptured basilar bifurcation aneurysm had significantly better outcome after coiling than after clipping. A prospective study was not possible, because most patients with basilar bifurcation aneurysms are now treated by coiling. Thus studies such as ours provide the best available evidence. However, its retrospective design resulted in incomplete data on outcome and in variable times of outcome assessment. We were only able to assess outcome in three rough categories: death, dependency on help for activities of daily living, and independence. We determined clinical outcome after a median of 3.5 months in the neurosurgically treated group and after 4.0 months in the coiled group, but in both groups the range was large. Evaluation of clinical outcome is preferably done at a fixed interval and after a longer period, especially in the neurosurgically treated group.

In logistic regression analyses we did not adjust for the amount of blood leakage on CT because of incomplete data, but as this is an important prognostic factor its omission may have introduced bias.

Many patients were operated on before 1994, whereas all endovascular patients were treated after 1994. However, the results of operation before 1994 were similar to those of operations done afterwards. In both institutions all basilar artery aneurysms were treated by one experienced senior neurosurgeon.

A possible advantage of surgical treatment is the ability to remove blood from the basal cisterns, to reduce the risk of ischaemia.[9] In our study, the risk of secondary ischaemia was comparable in both treatments. Thus our results do not support the view that the risk of secondary ischaemia is increased in patients who are treated by coiling.

Although the long term efficacy of coiling has not been assessed, our study shows promising results. In 26 coiled aneurysms results of control angiography performed after two years (median 23 months) were comparable with angiographic results six months after coiling.

Our results suggest that endovascular coiling is the preferred treatment for patients with ruptured basilar bifurcation aneurysms. If coiling is not feasible, operation must still be considered.

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