AJNR

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AJNR Am J Neuroradiol 2011, 32 (6) 1087-1090
doi: https://doi.org/10.3174/ajnr.A2458
http://www.ajnr.org/content/32/6/1087

ORIGINAL RESEARCH

Endovascular Treatment for Unruptured Intracranial Aneurysms in Elderly Patients: Single-Center Report

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BACKGROUND AND PURPOSE: The optimal management of patients with unruptured intracranial aneurysms remains controversial in elderly populations. The aim of this study was to evaluate technical results and clinical outcomes in a single center of consecutive elderly patients with unruptured intracranial aneurysms treated with endovascular embolization.

MATERIALS AND METHODS: Between May 2003 and February 2010, 96 patients older than 70 years (men, 16 patients; women, 80 patients; mean age, 73 years) with 122 saccular unruptured intracranial aneurysms were treated in our hospital with an endovascular approach. The endovascular procedures and technique, angiographic follow-up, and complications were evaluated.

RESULTS: Successful embolizations without complications were completed in 95.9%. Five patients had procedure-related events, including thromboembolism in 1 patient, aneurysm perforation during the procedure in 1, and 3 postoperative transient minor symptoms (headache, otalgia, and trigeminal pain) in 3. The degree of occlusion of the treated aneurysm was complete in 46.7%; there was a small neck remnant in 40.9% and residual filling in 12.2%. Imaging (MR angiography) follow-up was performed in 68.7% of the patients. The mean follow-up duration was 19.4 months (range, 5–57 months). Fifty-five patients (93.9%) showed no interval change of the residual neck. Four (6%) demonstrated recanalizations, all of which were successfully recoiled.

CONCLUSIONS: Endovascular treatment of unruptured intracranial aneurysms in patients older than 70 years of age appears to be safe. Favorable outcomes with low morbidities may replace surgery or conservative treatment as an active management alternative.

ABBREVIATIONS: ACA = anterior cerebral artery; AcomA = anterior communicating artery; BA = basilar artery; ICA = internal carotid artery; MCA = middle cerebral artery; PcomA = posterior communicating artery; SAH = subarachnoid hemorrhage; VA = vertebral artery

The natural history of unruptured intracranial aneurysms, including annual bleeding risk, has been debated; optimal management of patients with asymptomatic unruptured intracranial aneurysms is currently controversial. As a result of improved health care and longer life expectancy in the modern world, we have watched the increasing incidence of SAH and frequent detection of unruptured aneurysms in elderly patients.[1-13]

Endovascular treatment of unruptured intracranial aneurysms has made remarkable progress during the past 10 years and has become widely used.[14-18] Selective embolization with detachable coils has been accepted as an alternative to surgical clipping, with lower morbidity and mortality rates. Endovascular coiling has allowed us to treat more patients, including elderly individuals, in whom surgical clipping is considered risky.[19-25] Nevertheless, few studies[26] assessing the results of endovascular treatment for unruptured intracranial aneurysms in elderly patients have been undertaken, and optimal management of patients with unruptured intracranial aneurysms and the feasibility and the effectiveness of embolization are yet to be determined. We present our single-center experience of endovascular treatment in patients 70 years of age and older.

Received August 19, 2010; accepted after revision November 1.

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This study was supported by grant 02–2010–021 from the Seoul National University Bundang Hospital Research Fund.

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DOI 10.3174/ajnr.A2458

Materials and Methods

Patients

Between May 2003 and February 2010, 96 patients older than 70 years with 122 unruptured intracranial aneurysms were treated in our hospital with an endovascular approach. They included 80 women (83.3%) and 16 men (16.6%) with a mean age of 73 years (range, 70–90 years) (Table 1). The selection criteria for this study were the following: 70 years or older at the time of the operation; endovascular treatment chosen as the first line of treatment; and exclusion of patients with fusiform, traumatic, or mycotic aneurysms. All patients underwent conventional angiography of both carotid arteries and VAs. The presentations at admission were mostly incidental findings (41 patients, 42.7%), headache (18 patients, 18.7%), and dizziness (13 patients, 13.5%) (Table 2).

Aneurysm Characteristics

There were 111 anterior circulation aneurysms (90.9%) and 11 posterior circulation aneurysms (9.1%). The PcomA (32 aneurysms, 26.2%) and paraclinoid ICA (31 aneurysms, 25.4%) were frequent aneurysm sites (Table 3). In our study, multiple aneurysms were seen in 16 patients (13.1%). There were 21 small (<4 mm), 81 medium

Table 1: Patient characteristics (*N* = 96, 122 aneurysms)

	No. (%)
Sex	
Female	80 (83.3)
Male	16 (16.6)
Age (yr)	
70–74	65 (67.7)
75–79	26 (27)
80–84	3 (3.0)
>84	2 (2.0)

Table 2: Presentation at admission (*N* = 96)

Symptoms and Signs	No. (%)
Incidental finding	41 (42.7)
Headache	18 (18.7)
Dizziness	13 (13.5)
Diplopia	5 (5.2)
Memory disturbance	3 (3.0)
Limb weakness	3 (3.1)
Ptosis	3 (3.1)
Vertigo	2 (2.1)
Tinnitus	2 (2.1)
Paresthesia	1 (1.0)
Tremor	1 (1.0)
Syncope	2 (1.9)
Recanalization	2 (1.9)

Table 3: Location of aneurysms (*N* = 122)

	No. (%)
ACA	5 (4.1)
AcomA	17 (13.9)
ICA	31 (25.4)
PcomA	32 (26.2)
MCA	26 (21.3)
BA	10 (8.1)
VA	1 (0.8)
Total	122

(4–10 mm), and 20 large (>10 mm) aneurysms, and there were 67 aneurysms with small necks and 55 with wide necks (neck size, >4 mm) (Table 4).

Endovascular Embolization Procedure

Coiling of aneurysms was performed on a biplane angiographic unit (Integris BN V3000; Phillips Healthcare, Best, the Netherlands). Embolization was performed after induction of general anesthesia and systemic heparinization (3000-IU bolus, followed by continuous intra-arterial infusion of heparin at 1000 IU/h) and maintenance of an activated coagulation time to twice the control value. After roadmapping, a microcatheter (Excelsior SL-10, Boston Scientific, Natick, Massachusetts; or Prowler 14, Cordis, Miami Lakes, Florida) with an appropriate tip shape was carefully inserted into the aneurysm over the guidewire, and coils were then introduced. Aneurysms were embolized by using large-size frame coils (Guglielmi detachable coils, Boston Scientific) down to small soft filling coils ≤2 or 3 mm in diameter. The aim of coiling was to obtain an attenuated packing of the aneurysm, until not a single coil could be placed.

In 51 aneurysms (41.8%), the treatment was performed solely with a conventional single-catheter technique. For wide-neck aneurysms, a multiple catheter technique (45 aneurysms, 36.8%), a balloon-assisted technique (12 aneurysms, 9.8%), and a stent-assisted technique (10 aneurysms, 8.2%) were used. A combined multiple-catheter and a stent-assisted technique was used in 2 patients (1.6%) (Table 5).

Table 4: Aneurysm size (*N* = 122)

Size	No. (%)
Aneurysm	
Small	21 (17.2)
Medium	81 (66.3)
Large	20 (16.3)
Neck	
Small	67 (54.9)
Wide	55 (45.1)

Results

Angiographic Outcomes

Endovascular treatment resulted in 57 complete obliterations with no contrast filling of the aneurysmal sac (46.7%), 50 small residual necks (40.9%), and 15 residual delayed contrast stagnations of the aneurysmal sac (12.2%) (Table 6).

Imaging (MR angiography) follow-up (mean follow-up duration, 19.4 months; range, 5–57 months) was performed in 66 of 96 patients (68.7%). Fifty-five patients (93.9%) showed no interval change of the residual neck. They did not require further treatment. Four (6%) had recanalizations of the aneurysmal sac, all of which were successfully recoiled (Table 6). In summary, our series comprised mostly medium-sized aneurysms (81 aneurysms, 66%), single- or multiple-catheter techniques (96 patients, 88.6%), and successful stationary angiographic results with minimal recanalization (4 patients) (Tables 4–6).

Clinical Outcomes and Complications

In most patients (95.9%), coiling was performed without any adverse events. Procedural events occurred in 5 patients (4.1%) (Table 7). One patient had a thromboembolic complication during the procedure. It was completely recanalized with intra-arterial thrombolysis, and the patient showed no neurologic deficit. Perforation of the aneurysmal sac developed during the procedure in 1 patient. Fortunately, bleeding stopped with further coiling, and the patient did not have any neurologic deficits. Some minor problems such as otalgia, headache, and trigeminal pain developed after the procedures, but they improved spontaneously. So, clinically, no one had a permanent neurologic deficit.

Discussion

Many previous studies have shown that patient age was a significant predictor for subsequent aneurysm rupture.[27,28]

Table 5: Coil embolization technique (*N* = 122)

	No. (%)
Single catheter	53 (43.0)
Multiple catheters	45 (36.8)
Balloon-assisted	12 (9.8)
Stent-assisted	10 (8.2)
Multiple catheters + stent-assisted	2 (1.6)
Total	122

Table 6: Angiographic outcomes ($N = 122$)

	Immediate (%)	Recanalization[a]
Complete obliteration with no contrast filling of the aneurysmal sac	57 (46.7)	3
Residual contrast filling of the aneurysmal neck	50 (40.9)	1
Residual contrast filling of the aneurysmal sac	15 (12.2)	
Total	122	4

[a] Follow-up image was obtained by MR angiography ($n = 66$).

Table 7: Complications and results ($n = 5$)

Complication	No.	Results
Thromboembolic	1	Improved after thrombolysis (1 case)
Penetration of aneurysm	1	Spontaneous hemostasis
Otalgia	1	Improved
Headache (parietal laterality)	1	Improved
Trigeminal pain	1	Improved

Weir[29] noted that the rate of aneurysm rupture progressively increases with age. In the report of Wiebers et al,[30] the patient's age was an important factor with a substantial increase in risk for those approximately 50 years of age and older, which rises substantially after 60–70 years of age.[31] In Japan and Finland, reported rupture rates of cerebral aneurysms are almost twice those of other countries.[31] One possible explanation is a relatively larger older population in these countries. On the other hand, the lower incidence of aneurysm rupture in South and Central America can perhaps be explained, in part, by a relatively larger younger population in these regions.[31]

Many physicians have not recommended active treatment of unruptured intracranial aneurysms for older individuals because of their relatively short life expectancy and potential hazards related to treatment. However, it is obvious that the absolute rupture risk does not decrease with age. The rupture risk may be higher than in younger patients. In the literature, many epidemiologic studies agree that there is an increase in the incidence of SAH with advancing age. In many developed countries, SAH after of 70 years of age has been a frequent pathology.[1,2,15,16,21,23,30,32,33] Some authors believe that there is not a persistent increase of rupture risk. They argue that a maximum level is reached by the age of 70 years, and then a decrease is expected.[29] However, others confirm that there is an increase in the incidence of SAH in a linear model, even in patients older than 70 years of age.[27,28,30,31]

All decisions should be based on the risk-versus-benefit rules. If we can reduce treatment-related morbidity significantly, active management of unruptured intracranial aneurysms in older patients could be valid. Since the introduction of the Guglielmi detachable coils, the technical and device advances in this field have been tremendous. Procedural morbidity has also been decreasing.[14,15,19-21,23-25] In addition, unlike open surgery, endovascular morbidity and mortality seem to be less dependent on a patient's age.[11,31,34]

Our series demonstrated that endovascular coiling of elderly patients with unruptured intracranial aneurysms is safe and effective. Outcomes were excellent in most cases (95.9%). Procedure-related events occurred in some (4.1%), such as young patients, but the permanent deficit rate was 0%. Regarding rebleeding, in our series, none rebled after treatment during follow-up periods. Our series showed 6% of patients (4 of 66 at follow-up) required retreatment due to recanalization. This outcome is more favorable than that in previous studies, and all retreatments had good outcomes.

There have been several reports on outcomes of coiling in elderly patients. Barker et al,[26] in a retrospective study, used the Nationwide Inpatient Sample data for the years 1996–2000. This study demonstrated that endovascular coiling had a better discharge disposition than surgical clipping in patients older than 65 years. The reports of Cai et al,[35] including 63 elderly patients, and Gonzalez et al,[36] with 205 patients, also showed favorable outcomes. However, patients in these studies had a mixture of ruptured and unruptured aneurysms (22 unruptured aneurysms and 41 ruptured aneurysms,[35] and 97 unruptured aneurysms and 99 ruptured aneurysms[36]), relatively shorter follow-up times (13 months[35] and 16.2 months[36]), higher procedure-related complication rates (19%[35] and 8.7%[36]), and higher recanalization rates (17%[35] and 17%[36]) than those in our study.

It may be still logical not to actively treat unruptured intracranial aneurysms in elderly patients. They may have multiple comorbidities that could lead to more procedural risks. Treatment efficacy may not last because the elderly patient's life expectancy is short. However, our series demonstrates that the procedural morbidity could be kept low enough to make endovascular coiling for unruptured intracranial aneurysms valid in elderly patients. None of our patients with coiling have died from SAH, and all have enjoyed lives without fear of aneurysm rupture after treatment since 2003. We do not believe that our series will guarantee the safety of coiling of unruptured intracranial aneurysms in elderly patients in all institutes and all situations. However, our series suggests that if neurointerventionists can keep very low procedural risks, endovascular coiling of unruptured intracranial aneurysms in elderly patients could be a valid recommendation.

Conclusions

The results presented in this article encouraged us to consider elderly patients as primary candidates for endovascular treatment of unruptured intracranial aneurysms, mainly those patients in good neurologic states. Nonetheless, one should be aware that the risk of technical complications is most important in this group of patients. We conclude that unruptured intracranial aneurysms in elderly patients can undergo surgery with an endovascular approach irrespective of other factors, if it is technically possible, and old age itself does not increase the risk of complications. However, long-term risk, the durability of treatments, and data from prolonged follow-up of treated patients should be considered, even though endovascular treatment might be associated with less short-term risk. Moreover, further studies should be performed in a prospective randomized manner to define precisely the predictors of outcome in elderly patients to give a more exact basis for the decision-making process.

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