Treatment and Outcome of Anterior Inferior Cerebellar Artery (AICA) Aneurysms: Helsinki Series of 15 Consecutive Patients.

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Research Article

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Abstract

Background: Anterior inferior cerebellar artery (AICA) aneurysms are rare posterior circulation lesions that are challenging to treat.

Objectives: To present the treatment and clinical outcome of AICA aneurysms in an unselected cohort of patients.

Methods: A retrospective analysis of patient record files, DSA and CT angiography images of 15 consecutive patients harboring AICA aneurysms treated between 1968 to 2017.

Results:

Eighty percent of the AICA aneurysm patients were females. Twenty percent presented with intracerebral hemorrhage (ICH) and 40% had intraventricular hemorrhage. Eleven (73%) patients suffered from subarachnoid hemorrhage (SAH); a good-grade SAH (Hunt and Hess grade 1-3) was observed in 82 % SAH patients. Surgery was performed in 73 % patients. Coil embolization was done in 7% patients and 20 % patients were treated conservatively. In 73 % patients retrosigmoid approach was used and in 27 % patients a sub-temporal approach with anterior petrosectomy was applied. A parent vessel occlusion was needed to occlude the aneurysm in 18 % patients.

Conclusion:

Surgical treatment of AICA aneurysms has a high rate of cranial nerve deficits but most of patients have a good long-term clinical outcome. Surgical treatment may be an option only in selected cases of AICA aneurysms.

Introduction

Anterior inferior cerebellar artery (AICA) aneurysms are rare lesions and account for <1% of all intracranial aneurysms [1,2]. Except a few larger case series [3], only case reports with a single or a few patients have been reported [1,4-63]. Drake and colleagues reported a larger series of AICA aneurysms. However, they also included aneurysms originating from the basilar trunk near the origin of AICA. Both surgical and endovascular treatments of AICA aneurysms are challenging as these aneurysms are more often fusiform in morphology. Recent multicenter studies have shown that endovascular coiling has a better outcome than surgical clipping of posterior circulation aneurysms [64]. Although most of these trials included patients with posterior circulation aneurysms that harbored PICA or basilar bifurcation aneurysms, endovascular coiling has now been accepted as a favored treatment option for all posterior circulation aneurysms [65]. However, if parent vessel occlusion and a revascularization procedure is needed, surgery may still be a better choice in such selected cases due to the often larger size and fusiform shape of AICA aneurysms [27,58]. We report our series of patients harboring AICA aneurysms admitted during 1968 to 2017 to the department of Neurosurgery at Helsinki University Hospital. We

discuss treatment options (including the role of surgery) for AICA aneurysms. Moreover, we discuss different surgical approaches for clipping AICA aneurysms, post-operative complications, and clinical outcomes in Helsinki series of AICA aneurysms.

Methods

Patients and radiological data

We retrospectively identified 21 patients with AICA aneurysms comprising 0.22% of the aneurysms admitted during the time period. After exclusion of aneurysms with missing CT angiography scans or DSA, 15 patients with AICA aneurysms were identified. Analysis of CT angiography images until 2007 was performed with a 4-slice scanner (GE Lightspeed QX/I; GE Medical Systems, Milwaukee, Wisconsin, USA) and later with a 32-slice scanner (GE LightSpeed Pro 32) or a 64-row scanner (GE lightSpeed VCT Advantage). Images were stored in the digital archiving system of the hospital (IMPAX, version 5.3, Agfa, Mortsel, Belgium). Analysis of CT angiography scans was performed by two board-certified neurosurgeons (figure 1).

The study was in accordance with the declaration of Helsinki. The patient data was completely anonymized. The study was approved by local ethical committee at Helsinki University. An additional approval for the collection of retrospective data or additional patient consent was not required.

Clinical outcome

For each patient we retrieved data on initial clinical grade on admission. Patients with Hunt and Hess grade 1 to 3 were classified as good clinical grade. Patients with subarachnoid hemorrhage (SAH) and patients with Hunt and Hess grade 4 to 5 were classified as poor grade SAH. Data on surgical approach and on postoperative cranial nerve deficits were retrieved from patient electronic record files. Clinical outcome was quantified using modified Rankin scale (mRS). Patients with mRS 1 to 2 were classified as good clinical outcome whereas patients with mRS 3 to 6 were classified as poor clinical outcome.

Statistical Analysis

Data were analyzed using the commercial statistical software IBM SPSS version 20.0.0. Data are presented in frequencies (percentage) or mean ± SD.

Results

Patients and presentation

Of the 15 AICA aneurysm patients analyzed, 12 (80%) were females and the remaining 3 (20%) were males. Twenty percent had ICH and 40% presented with intraventricular hemorrhage (table 1). Eleven out of fifteen (73%) patients presented with SAH and 82% of SAH patients had good-grade SAH (Hunt and Hess grade 1-3).

Treatment

Four patients presented with cranial nerve deficits without SAH. Eleven patients (73%) were treated surgically, 3 (20%) were treated conservatively, and 1 (7%) had coil embolization. In 27% of patients, a subtemporal approach with anterior petrosectomy was performed. In the remaining 73%, the aneurysms were approached through a retrosigmoid approach with or without modifications. In 18% of the patients, a parent vessel occlusion was necessary to occlude the aneurysm.

Clinical outcome

Five out of eleven (47%) of patients who underwent surgery developed post-operative cranial nerve deficits including oculomotor and abducens (n=1), Abducens (n=2), glossopharyngeus (n=1) and Facial nerve palsy with hearing loss (n=1). Twenty-seven percent developed shunt-dependent hydrocephalus. All patients who presented with an unruptured AICA aneurysm had good clinical outcome (mRS 1-2). In patients with SAH, 82% achieved good clinical outcome (mRS 1-2) and 18% had poor clinical outcome (mRS 3-6) after 1 year (table 2).

Discussion

Due to their often larger size and fusiform shape (in about 33 % of cases), AICA aneurysms are a special group of posterior circulation aneurysms that may more often require surgery compared with other posterior circulation aneurysms. Selection of surgical approach is an important factor because of critical location of the aneurysm near important cranial nerves. There are two key factors that determine the approach during microsurgical clipping of AICA aneurysms. These are the height of the aneurysm in relation to the clivus and the segmental location of the aneurysm along the artery. High-lying AICA aneurysms can be accessed through a subtemporal approach with an additional petrosectomy. The far-lateral approach is suitable for low-lying AICA aneurysms near the origin of the basilar artery. A retrosigmoid approach including its modifications is a simple and straightforward approach that can expose most parts of the AICA below the fifth cranial nerve and around the internal auditory meatus [66]. A lumbar drain is helpful to release CSF and increase the surgical exposure while operating through a retrosigmoid approach. In our series, 3 out of 11 patients were operated through a subtemporal approach with anterior petrosectomy and the other 8 were operated through a retrosigmoid approach with some extension according to location of the aneurysm. It is important to take special care to avoid injuring the sixth cranial nerve during anterior petrosectomy. In the series of Drake, most of the patients were treated through a subtemporal approach with a very high rate of post-operative sixth nerve injury. In our series, 46% (33% already pre-operatively) of the patients presented cranial nerve deficits, which is lower than that reported in the literature [3]. The high rates of cranial nerve deficits are due not only to direct injury to the nerve but also vascular injury of the vasa nervorum, which can cause significant cranial nerve deficits [40]. Twenty-seven percent of patients developed shunt-dependent hydrocephalus, which is consistent with the literature. The overall clinical outcome in surgically treated patients is heavily dependent on the presentation status of the patient and the surgical skills of the neurosurgeon. In our series, all patients

(n=4) who presented with unruptured aneurysms achieved good clinical outcome (mRS 1-2). Patients who presented with good-grade SAH (Hunt and Hess grade 1-3; n=9) achieved good clinical outcome (mRS 1-2). Two patients with poor-grade SAH achieved poor clinical outcome (mRS 3-6). One patient in our series was coil embolized and had an initial Hunt and Hess grade 2; this patient also achieved mRS 2 at 1 year after treatment. For the conservatively treated patients, 1 patient who had SAH in 2003 lived until 2012 and reached mRS 3 at 1 year after SAH. One patient who was admitted with poor-grade SAH died after 1 day of hospitalization. The third patient in the conservative group who was admitted with SAH in 1968 achieved mRS 1 at 1 year after SAH. This patient later died due to prostate carcinoma. The reason for the low rate of rebleeding may be the high rate of thrombosis of these aneurysms. Although our surgical results are comparable to endovascular coiling, multicenter controlled and randomized trials in recent years have demonstrated that endovascular coiling is a better treatment for posterior circulation aneurysms. Thus, endovascular coiling has now become the standard first-choice treatment for all posterior circulation aneurysms (including AICA) in most neurosurgical centers worldwide.

Limitations:

Our analysis is retrospective and may not completely reflect the natural disease course. Due to the low number of patients, we could not analyze the influence of surgical approach and segmental location of the aneurysm on clinical outcome.

Conclusion

Although surgical treatment of AICA aneurysms has a high rate of cranial nerve deficits, most patients achieve a good long-term clinical outcome. Surgical treatment may still be an option in selected cases of AICA aneurysms. Based on this series and previous policy of our hospital to ignore endovascular therapy, it maybe not possible to give a clear recommendation. This is biased towards surgery.

Declarations

Authors contribution

Conceptualization: SM, MN, BRJ

Data Collection: SM, AH, HK, BRJ

Manuscript writing and statistical analysis: SM

Review of manuscript: SM, AH, HK, BRJ, RK, DH, MN

Conflict of Interest

Authors have no conflict of interest

Ethics approval

The study was approved by local ethical committee at Helsinki University.

Consent to participant

An additional approval for the collection of retrospective data or additional patient consent was not required.

Consent for publication

The authors consent the publication of the article.

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Tables

Table 1: Clinical presentation of anterior inferior cerebellar artery aneurysms (n=15)

	Mean	Percentage
Presentation		
Males	3	20
Females	12	80
Intracerebral hemorrhage (ICH		
Intracerebral hemorrhage (ICH)	3	20
No ICH	12	80
Intraventricular hemorhage (ICV)		
Intraventricular hemorhage (ICV)	6	40
No ICV	9	60
Presntation (n=15)		
Unruptured	4	26.7
Ruptured	11	63.3
Hunt and Hess grad (n=11)		
Hunt and Hess grad (1-3)	9	81.8
Hunt and Hess grad (4-5)	2	18.2

Table 2: Post-operative complications and clinical outcome of anterior inferior cerebellar artery aneurysms (n=15)

	Mean	Percentage
Presentation		
Treatment		
Conservative	3	20
Coiling	1	6.7
Clipping	11	73.3
Approach (n=11)		
Subtemporal + anterior petrosectomy	3	27.3
Retrosigmoid (with its modifications)	8	72. 7
Parent vessel occlusion (n=11)	2	18.2
Post-OP Cranial nerve Deficits (n=11)		
Yes	5	46.5
No	6	54.5
Hydrocephalus		
Shunt dependent hydrocephalus	4	26.7
No hydrocephalus	11	73.3
Post-OP CSF leak	1	9.1
Clinical outcome unruptured (n=4)		
mRS (1-2)	4	100
mRS (3-6)	0	0
Clinical outcome ruptured (n=11)		
mRS (1-2)	9	81.8
mRS (3-6)	2	18.2

Figures

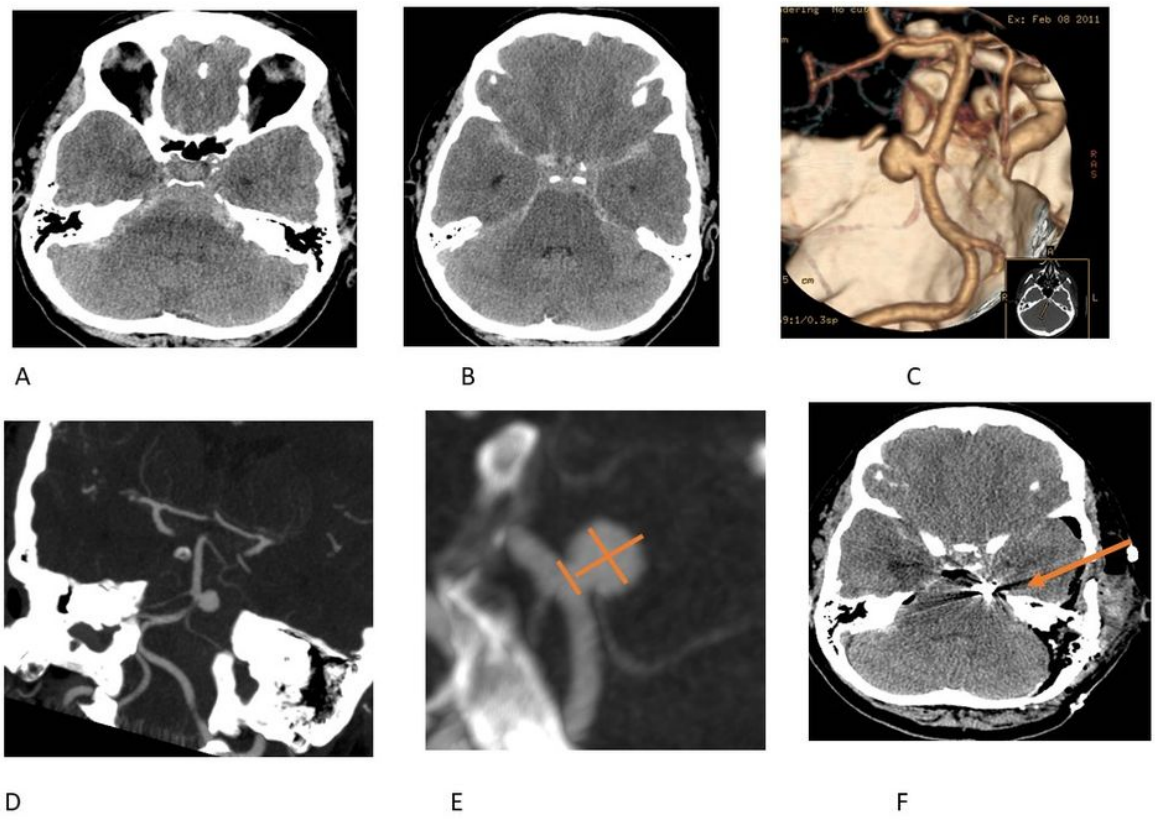

Figure 1

Computer tomography showing subarachnoid hemorrhage (A, B) from an AICA (proximal) aneurysm (C, D, E). Aneurysm clipping was performed through a subtemporal approach (F).