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Clinical and imaging follow-up after surgical or endovascular treatment in patients with unruptured carotid–ophthalmic aneurysm

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ABSTRACT

Background: Carotido-ophthalmic aneurysms are complex and their treatment is challenging. Few data are available on patient follow-up after endovascular or surgical treatment.
Objective: To evaluate outcome of patients with unruptured carotido-ophthalmic aneurysm after endovascular or surgical treatment.
Materials and methods: This series included 52 consecutive patients in a single center treated for an unruptured carotido-ophthalmic aneurysm at Lille University Hospital between 2000 and 2011. Visual disturbances were present in 5 patients. Treatment option (endovascular or microsurgical) was decided for each patient in a multidisciplinary meeting. We recorded age and the American Society of Anesthesiology score (ASA) before treatment and the modified Rankin Scale score (mRS) at 3 months after treatment. All patients had conventional angiography performed before and immediately after treatment. Long-term imaging follow-up was performed at 3 years after treatment.
Results: Treatment was endovascular in 29 patients and microsurgical in 23. The mean follow-up was 4.6 years. Conventional angiograms showed multiple intracranial aneurysms in 26 patients. Age, pre-therapeutic ASA score and mRS score at 3 months after treatment showed no significant difference between microsurgery and endovascular treatment. Imaging follow-up showed aneurysm recurrence after endovascular treatment in 6 patients including 3 with major recurrence that required further treatment by microsurgery. In these 3 major recurrences, the initial conventional angiography demonstrated the origin of the ophthalmic artery at the neck or from the aneurysmal sac in 3 cases. After microsurgery, conventional angiography showed a remnant neck in 2 patients including 1 treated by further endovascular procedure.
Conclusion: Endovascular treatment remains the first therapeutic option when the ophthamic artery originates at a distance from the neck, but microsurgery should be considered for large aneurysms with optic nerve compression, or when the ophthalmic artery arises from the neck of the aneurysm.

1. Introduction

Paraclinoid aneurysms arise from the internal carotid artery (ICA) between the roof of the cavernous sinus and the origin of the posterior communicating artery [2,6]. Three aneurysmal variants originate from the ophthalmic segment of the ICA: ophthalmic artery, superior hypophyseal artery, and dorsal types [10]. This study focused on ICA aneurysms whose neck is located near the origin of the ophthalmic artery (so called carotid ophthalmic aneurysms). These aneurysms are rare and their management is challenging for both endovascular and microsurgical treatments [3,4,21]. Microsurgical approach is technically challenging due to the anterior clinoid process, the proximity of the optic nerve and the origin of the ophthalmic artery [1,15]. Endovascular treatment may be limited by the close proximity of the aneurysmal neck to the ophthalmic artery that may potentially lead to a visual loss after coiling [18]. A multidisciplinary discussion between neurosurgeons, neuroradiologists and intensivists is necessary to choose the optimal treatment. The objective is to preserve the visual function while performing a complete exclusion and reliable long term of the aneurysm. Besides bleeding, visual disturbances by compression of the optic pathways may reveal these vascular malformations,

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Table 1
Summary of main demographical data, radiological features and outcomes.

	Number of patients	Mean age at diagnosis	Mean neck diameter	Mean sac diameter	Remnants after treatment	Recurrence	Re-treatment
Endovascular treatment	29	46.8	4.8	8.5	6	6	3
Microsurgery	23	44.3	4.1	7.1	2	0	1

especially in case of large or giant aneurysms [13]. Our study aimed to evaluate the outcome of patients with carotid–ophthalmic aneurysm after treatment.

2. Materials and methods

2.1. Population

This is a monocentric, retrospective and continuing series of 52 patients with an unruptured carotid–ophthalmic aneurysm followed from 2000 to 2011 at Lille University Hospital. We obtained IRB approval to perform this study. The study population included 5 men and 47 women with a mean age at diagnosis of 45 years (range 24–67 years; SD: ±11). The type of treatment (endovascular or microsurgical) have been decided for each patient in a multidisciplinary discussion including neurosurgeons, neuroradiologists and intensivists. Among 52 patients (Table 1), 29 underwent endovascular treatment (group A) and 23 had microsurgical treatment (group B).

2.2. Clinical and radiological follow-up

All patients had a clinical examination performed by a senior neurosurgeon in our institution before the treatment. We recorded the age at diagnosis and the American Society of Anesthesiology (ASA) score before treatment. All patients were re-evaluated 3 months after treatment using the modified Rankin Scale score (mRS). When visual symptoms were present, visual examination was performed few weeks before the therapeutic procedure and 6 months after. The size and location were evaluated for all carotid–ophthalmic aneurysms by a conventional cerebral angiography. Magnetic resonance imaging (MRI), using a specific protocol [22] was sometimes performed to confirm the supra-clinoid location of the aneurysm. Patients with giant or large aneurysm (>20 mm) and patients with transitional aneurysm have not been included in our study. Conventional cerebral angiography was performed for each patient immediately after the treatment to reveal a possible aneurysmal remnant. For patient follow-up, the imaging protocol depended on the therapeutic approach. MR angiography was performed at 6 months, 18 months and 36 months in patients who underwent endovascular treatment whereas CT angiography was performed at 3 years in patients treated by surgery.

2.3. Data analysis

For statistical data analysis, the "Mann–Whitney *U* test" was used for normally distributed data. For non-numerical data, the Chi-squared test was used to compare the two groups. A p value < 0.05 was considered statistically significant. The analyses were performed using the SPSS statistical software, version 17 (SPSS Inc.).

3. Results

3.1. Population

The mean follow-up was 4.6 years (range 1.6–9.1; SD: ±0.8). Among the 52 patients, 26 harbored multiple intracranial aneurysms (13 in group A and 13 in group B). For 22 of these 26 patients, the other aneurysms were also located on both ICA segments (5 on the ipsilateral supraclinoid segment in group A and 4 on the group B).

Twenty-one patients had a hypertension history, 21 patients were smokers and 1 patient was followed for polycystic kidney disease.

3.2. Visual symptoms

Visual disturbances were present in 5 patients and were related to the mass effect over optic pathways. Two patients had only visual field disturbance, while 3 patients presented a severe decrease of ipsilateral visual acuity. The 5 patients underwent microsurgical treatment. No patient worsened his vision and one patient even experienced improvement of visual acuity (Table 2).

3.3. Therapeutic procedure

Microsurgery: Pterional approach was performed in 23 patients. The anterior clinoid process was resected in 10 patients to allow a better exposure of the aneurysmal neck. We recorded 2 transient aphasia in the postoperative period.

Endovascular treatment: The aneurysm was treated only by coiling in 22 patients, stenting and coiling in 5 patients and by a flow diverter in 2 patients. Two patients had transient aphasia after endovascular treatment and 2 others experienced visual loss (Table 3) on the side of treated aneurysm (Fig. 1), related to a thrombosis of the ophthalmic artery (1 after coiling and 1 after flow diverter).

Table 2
Visual outcome after microsurgical decompression.

Patient	Age at diagnosis	Neck diameter (mm)	Sac diameter (mm)	Visual disturbances	Optic atrophy	Treatment	Visual outcome
1	51	5	15	Visual acuity: 10/10 Temporal visual field disturbance	–	Microsurgery	Unchanged
2	37	5	11	Visual acuity: 1/10 Central scotoma	–	Microsurgery	Visual acuity: 4/10
3	45	4	13	Visual acuity: 3/10 Central scotoma	+	Microsurgery	Unchanged
4	30	6	11	Visual acuity: 1/10 Central scotoma	+	Microsurgery	Unchanged
5		9	12	Visual acuity: 10/10 Temporal visual field disturbance	–	Microsurgery	Unchanged