Treatment of Multiple Intracranial Aneurysms in the Anterior Circulation

—Case Report—

Toshiaki YAMAKI, Masayuki TAKEDA, Hiroshi TAKAYAMA
and Yoichi NAKAGAKI

Department of Neurosurgery, Sunagawa City Medical Center, Sunagawa, Hokkaido

Abstract

A 69-year-old female underwent surgery for subarachnoid hemorrhage due to a ruptured intracranial aneurysm. Nine additional aneurysms were found. Four of the latter nine aneurysms were clipped in a second operation, and two were wrapped.

Key words: intracranial aneurysm, multiple aneurysms

Introduction

We describe a case in which radiological examination revealed a ruptured right middle cerebral artery (MCA) aneurysm and nine other incidental aneurysms in the anterior circulation, seven of which were treated in two operations.

Case Report

A 69-year-old female suffered a sudden, severe headache and lost consciousness on October 19, 1984. She had been healthy until October 17, when she began to experience occasional headaches. On admission, 1 hour after the onset, she was lethargic and disoriented. Neurological examination revealed moderate left hemiparesis and nuchal rigidity. Deep tendon reflexes were exaggerated and the plantar reflex was abnormal bilaterally. Temperature was 35.8°C. She had a pulse rate of 60/min, a respiratory rate of 16/min, and a blood pressure of 140/90 mmHg.

Computed tomography (CT) revealed severe subarachnoid hemorrhage, which was most prominent in the basal cistern on the right side. A thick hematoma occupied the right Sylvian fissure. No ventricular dilatation or parenchymal lesions were detected. Cerebral angiography demonstrated nine

aneurysms, four within the right internal carotid artery (ICA) circulation (Fig. 1 *upper*) and five within the left ICA territory (Fig. 1 *lower*). More specifically, on the right side two aneurysms arose from the bifurcation of the MCA and two were on the distal MCA within the Sylvian fissure. On the left, two aneurysms arose at the trifurcation of the MCA and three from the anterior cerebral artery (ACA) at the junctions of the pericallosal and the callosomarginal arteries, the pericallosal and the paracentral arteries, and the callosomarginal and middle internal frontal arteries. The CT and angiographic findings indicated that the ruptured aneurysm was the largest saccular aneurysm with a lobulated configuration at the right M₁-M₂ junction. No aneurysms were detected in the vertebrobasilar circulation.

Through a right frontotemporal craniotomy, the neck of the ruptured aneurysm at the bifurcation of the right MCA was successfully clipped. An adjacent aneurysm was wrapped with gauze. During the operation, an aneurysmal dilatation was discovered on the ophthalmic artery, bringing the total number of aneurysms to 10. That aneurysm, and two small ones at the distal M₂ portion, were left untreated.

Postoperatively, she remained lethargic and the left hemiparesis did not improve. On the 6th day of hospitalization, she became drowsy and the left

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Author's present address: T. Yamaki, M.D., Department of Neurosurgery, Sapporo Medical College, Sapporo, Japan.

Fig. 1 *upper*: Right carotid arteriograms, anteroposterior and lateral views. A large, lobulated aneurysm at the knee of the middle cerebral artery (*arrow*) has ruptured; there is another aneurysm closely adjacent to it. Two M₂-portion aneurysms are visible in the lateral projection (*arrowheads*). An aneurysmal dilatation of the proximal ophthalmic artery is difficult to appreciate in these images but was detected during surgery. *lower*: Left carotid arteriograms, showing three aneurysms arising from the anterior cerebral artery and two from the middle cerebral artery (*arrows*).

hemiparesis worsened with paresis of right lower extremity. Repeated right carotid angiography revealed diffuse vasospasm and more clearly demonstrated the two distal M₂ portion aneurysms (Fig. 2).

She eventually improved somewhat and became verbally responsive. At this point, a second operation was performed. *Via* a left frontotemporal craniotomy, two aneurysms at the trifurcation of the left MCA were clipped and an aneurysm on the right internal carotid-ophthalmic artery was partially wrapped with muscle. Two ACA aneurysms, one at the pericallosal-callosomarginal artery junction and the other at the callosomarginal-middle internal frontal artery junction, were clipped *via* a right unilateral interhemispheric approach by medial extension of the right frontotemporal craniotomy (Fig. 3). The aneurysm at the junction of the pericallosal and the paracentral arteries was not treated because

Fig. 2 Right carotid arteriogram taken after the first operation. The two M₂-portion aneurysms are demonstrated more clearly because of angiospasm of the parent arteries (*arrowheads*).

Fig. 3 Postoperative left carotid arteriogram, showing the five clips. The ruptured aneurysm was clipped during the first operation, *via* a right frontotemporal craniotomy. The two aneurysms on the anterior cerebral artery were treated *via* a unilateral interhemispheric approach by widening of the previous craniotomy.

of its small size and its configuration, which was unsuitable for neck clipping.

Histological examination of the large, lobulated aneurysm at the left M₁ portion showed the typical structure of an aneurysmal wall, composed of connective tissue and sparse elastic fibers. There were no findings suggestive of a mycotic aneurysm. She showed no postoperative improvement.

Discussion

Until the present decade, there was much discussion concerning therapeutic approaches to unruptured intracranial aneurysms.^{1,9,11,15-17,19,20} However, this issue have been resolved by demonstration of the low surgical risk and the rather high risk of rupture.^{5,8,12,14,22,23,25} In 1977, Jane *et al.*¹² reported that the rate of rupture of an unruptured aneurysm is as high as 3-4% per year which is close to that of untreated ruptured aneurysms. On the other hand, Wirth *et al.*²⁷ reported in 1983 that surgical morbidity was as low as 6.5% and surgical mortality 0% in 107 cases of incidentally discovered aneurysms. Baena *et al.*³ reviewed the literature and summarized the correlation between the natural history and the surgical risk in patients with multiple aneurysms. They found that untreated unruptured aneurysms bled at the rate of 3% per year, with a cumulative mortality rate of 20%, whereas the outcome of surgery for unruptured aneurysms was good in 96% of cases. Their findings suggest that prophylactic surgical treatment of unruptured intracranial aneurysms is warranted, particularly if a patient is young and therefore has a high lifetime risk of rupture.

The specific problem in the case presented here was how extensively to treat the nine incidentally discovered aneurysms. According to an analysis of the world literature concerning intracranial aneurysms,⁶ 1.47% of patients had five more aneurysms. There have been only five reported cases in which there were seven or more aneurysms. Two of these patients underwent cervical carotid ligation and one underwent clipping of a ruptured aneurysm and wrapping of four unruptured aneurysms, all of which were on the same side. In the remaining two cases the treatment was not described. Complete obliteration of four aneurysms was first reported by Jackson *et al.*¹⁰ in 1974, who noted that the results were good. Hashimoto⁷ treated four of five aneurysms by neck clipping and applied a synthetic coating to the remaining one, also with good results. Our case exceeded those reported previously in the number of obliterated aneurysms in one patient.

Wiebers *et al.*²⁴ studied a series of 65 unruptured aneurysms and concluded that those larger than 1 cm should be operated on as soon as possible, because one half of the ruptures of these aneurysms occurred within 2.5 months of diagnosis. In a cooperative aneurysm study reported by Kassel and Torner¹³ in 1983, the median diameter of the ruptured aneurysms was 7.0 mm and 13% were less than 5 mm in diameter. According to Ausman *et al.*² the critical diameter in terms of rupture may be between 4 and 7

mm. Winn *et al.*²⁶ noted that a significant number of unruptured aneurysms do enlarge and rupture. It can be said that unruptured aneurysms are not benign, but rather pose a permanent risk to the patient. In our case, the two lobulated, saccular aneurysms in the knee of the left MCA appeared likely to bleed, on the basis of their size and configuration, and we decided, therefore, to surgically obliterate them.

Our patient was found to have three distal ACA aneurysms and two distal MCA aneurysms. Such peripherally located aneurysms are seldom congenital, unlike those in the vicinity of the circle of Willis. In the mid 1960s, Roach and Drake²¹ pointed out the clinical significance of distally located aneurysms of mycotic origin. Olmstead and McGee¹⁸ asserted that peripheral aneurysms are secondary to infection, tumor embolus, moyamoya disease, or trauma, excluding those at the genu of the MCA and those arising at the origin of the callosomarginal or frontopolar artery from the ACA. In our case, although one aneurysm arising from the bifurcation of the pericallosal and the callosomarginal arteries appeared to be congenital, while two aneurysms further distal on the ACA and two situated on the insular portion of the MCA were unusual in terms of their locations. However, the patient had no underlying disease likely to have caused the development of multiple aneurysms, and the histological findings were not suggestive of a mycotic origin. Zacks²⁸ described a patient with 13 aneurysms, seven of which were distal and which, like our patient's aneurysms, seemed to be congenital.

Needless to say, not all patients are candidates for prophylactic surgery. Brisman⁴ listed several considerations for deciding to surgically treat an asymptomatic aneurysm, which are: 1) the patient's age and general medical condition; 2) the location and configuration of the aneurysm, which determines the ease of access; 3) the size of the aneurysm (very small ones are less likely to bleed); and 4) the patient's choice, after the risks of surgery *versus* nonsurgery have been realistically and carefully explained. Although our patient was 69 years old and showed motor disability in three extremities, the size and configuration of the aneurysms on the left MCA indicated a likelihood of bleeding and were easy to treat. Therefore, we decided to perform a second operation and treat the other aneurysms at the same time. Altogether, five aneurysms were clipped and two were wrapped through bilateral frontotemporal craniotomies.

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Address reprint requests to: T. Yamaki, M.D., Department of Neurosurgery, Sapporo Medical College, South-1, West-16, Sapporo 060, Japan.