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## Aneurysm Arising from the Junction of Internal Carotid Artery and Duplicated Middle Cerebral Artery

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**Abstract** A case of an aneurysm arising from the junction of the internal carotid artery and duplicated middle cerebral artery was reported. A 77-year-old female was admitted to our hospital with complaints of headache, nausea, vomiting and disturbance of consciousness. CT scan showed a high-density area in the basal cistern and Sylvian fissure. Carotid angiography revealed saccular aneurysm arising from the junction of the right internal carotid artery and duplicated middle cerebral artery originating from the internal carotid artery. The neck of aneurysm was clipped via the basal interhemispheric approach on the day of onset. Transient right oculomotor nerve palsy occurred in the postoperative course. Normal pressure hydrocephalus was treated by ventriculoperitoneal shunt.

The relationship between the genesis of aneurysms and the duplicated middle cerebral artery was discussed. From the location of these aneurysms associated with the duplicated middle cerebral artery, we suggested that congenital etiological factors were modified by the acquired hemodynamic factors.

*Key Words:* Duplicated middle cerebral artery, Cerebral aneurysm

### Introduction

Vascular anomaly arising from the internal carotid artery (ICA) and supplying the territory of the middle cerebral artery (MCA) is known as duplicated middle cerebral artery. There have 25 reports of cerebral aneurysm associated with the duplicated middle cerebral artery and 7 reports of cerebral aneurysm at the origin of the duplicated middle cerebral artery<sup>(1-12)</sup>. Here we report a case of cerebral aneurysm arising from the origin of this artery. The relationship between the genesis of aneurysm and duplicated middle cerebral artery is discussed.

### Case report

A 77-year-old woman suffered acute headache, nausea, vomiting and loss of consciousness on July 31, 1989, and was transferred to our hospital on the same day. On admission, the patient was drowsy and showed nuchal rigidity. CT scan showed a massive subarachnoid hemorrhage. Right carotid angiography revealed a duplicated middle cerebral artery and a small aneurysm arising from the origin of this artery and oriented medially (Fig. 1). Left carotid angiography showed aneurysms at the origin of the anterior choroidal artery and in the cavernous portion of the ICA.

A bifrontal osteoplastic craniotomy with neck



Fig. 1 Right carotid angiogram showed a duplicated middle cerebral artery (arrow heads) and a small aneurysm (arrow) arising from the origin of this artery and oriented medially.

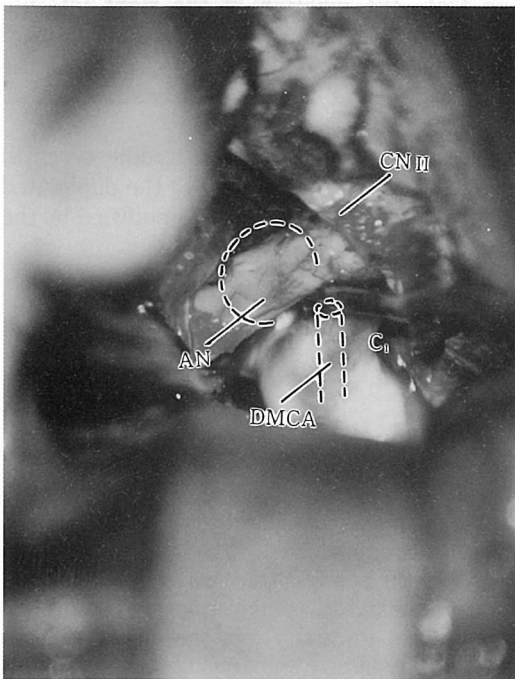


Fig. 2 Operative view shows the relationship between the aneurysm (AN) and  $C_1$  segment. The duplicated middle cerebral artery (DMCA) originated back of the  $C_1$  segment. CN II: optic nerve.

clipping via the basal interhemispheric approach was performed on the day of onset. The aneurysm was oriented medially from the ICA (Fig. 2). The duplicated middle cerebral artery originated at the ICA proximal to the aneurysm. The right oculomotor nerve adhered to the aneurysmal dome and was freed from the aneurysm. The neck of the aneurysm was clipped with a Yasargil clip. Transient right oculomotor nerve palsy occurred after the operation. Normal pressure hydrocephalus was treated by a ventriculo-peritoneal shunt 2 months after surgery. Postoperative angiography showed disappearance of the aneurysm and preservation of the duplicated middle cerebral artery (Fig. 3). The patient left hospital on foot on Nov. 18, 1989.

#### Discussion

Duplicated middle cerebral artery is defined as an artery arising from the internal carotid artery which supplies the territory of the middle cerebral artery. This artery is distinguished from accessory middle cerebral artery arising from the anterior cerebral artery. Among 347 autopsies, Crompton et al. found 10 branches arising from the internal carotid artery between the origin of the anterior choroidal artery and the terminal bifurcation of the internal carotid into the middle cerebral and anterior cerebral



Fig. 3 Postoperative carotid angiogram showed disappearance of the aneurysm and preservation of the duplicated middle cerebral artery.

Table 1 Summary of reported cases with aneurysms arising from the origin of duplicated middle cerebral artery

Case No.	Author	Year	Age	Sex	Side	Other aneurysm
1	Crompton et al.*	1962	?	?	?	—
2	Stabler	1970	31	F	rt.	lt. IC
3	In et al.	1981	29	F	rt.	—
4	Fuwa et al.	1984	46	F	rt.	—
5	Kitami et al.	1985	46	F	rt.	lt. MC
6	Kitami et al.	1985	60	M	rt.	—
7	Takano et al.	1988	74	M	rt.	—
8	Present case	1990	77	F	rt.	lt. IC, lt. IC-Ch

\*Details not described. F: female M: male  
 IC: internal carotid artery, MC: middle cerebral artery,  
 Ch: anterior choroidal artery

arteries and passing along the course of the middle cerebral artery. Such a branch was termed accessory middle cerebral artery<sup>(1)</sup>. In the same study, they found a branch arising from the anterior cerebral artery (ACA), passing back into the sylvian fissure and then becoming distributed in the same region. However, no term for this branch was given. Jain reported 8 cases in which the branch arose from the ACA and 2 in which it arose from the internal carotid artery<sup>(13)</sup>. He termed these branches accessory MCA. On the other hand, McCormick and Teal et al. defined a branch arising from the ACA as accessory MCA and that arising from the

ICA as duplicated MCA<sup>(14,15)</sup>. The latter opinion is now widely accepted.

In the literature, 55 cases of duplicated MCA have been reported<sup>(1-16)</sup>. The incidence of duplicated MCA is 0.2-2.9% among autopsy cases<sup>(1,13,14,16,17)</sup>. The etiology of this condition is a residual primitive vessel network or arterial misplasty occurring at about fetal stage 5, or 40 days of gestation<sup>(12)</sup>.

Duplicated MCA can coexist with other intracranial anomalies, including accessory MCA, agenesis of the internal carotid artery, moyamoya disease or cerebral aneurysm<sup>(1-12,18)</sup>. Including the present case, there have been 26 reports of cerebral aneur-

ysm associated with duplicated MCA and 8 of cerebral aneurysm arising from the origin of duplicated MCA (Table 1).

Congenital factors involved in aneurysm formation include congenital defect of the media, residual fetal arteries and developmental anomalies of the artery at the fetal stage<sup>(19)</sup>. George and Miyazaki et al. pointed out derangement of primitive arteries and frequent association of aneurysm with other vascular anomalies as findings supporting the congenital theory<sup>(8,20)</sup>.

Acquired factors involved in aneurysm formation include degenerative changes in the arterial wall and hemodynamic stress on the arterial wall<sup>(21-26)</sup>. Kwak et al. and Kinoshita et al. suggested that blood pressure loading by the anomalous artery and degeneration of its wall were acquired factors responsible aneurysm formation<sup>(7,27)</sup>.

Kitami et al. pointed out that duplicated MCA has the same morphology as bifurcation of the normal MCA<sup>(5)</sup>. They concluded that the mechanism of aneurysm formation in cases of duplicated MCA was the same as that in other cases of aneurysm.

In the literature, 8 of 21 cases of duplicated MCA had aneurysm at the origin of the duplicated MCA, and 5 had aneurysm in the ipsilateral ICA. Thirteen of the 21 cases, 62%, had aneurysms around the origin of the duplicated MCA. This finding suggests that duplicated MCA produces hemodynamic stress on the arterial wall that may result in aneurysm. Seventeen of 28 cases of duplicated MCA occurred on the right side and 11 on the left. However, all cases except one (that of Crompton et al.) with aneurysm at the origin of the duplicated MCA had the duplicated MCA on the right side. This suggests a congenital factor in the mechanism of aneurysm formation.

## Conclusion

A case of cerebral aneurysm arising from the origin of the duplicated middle cerebral artery was reported. It was suggested that congenital etiological factors involved in aneurysm formation are modified by acquired factors.

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