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Carotid-Superior Cerebellar Anastomosis : A Variant of  
Persistent Trigeminal Artery Associated with Cerebral  
Aneurysms and Angiomatous Malformation  
—Case Report—

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Recently, several cases of carotid-cerebellar artery anastomosis have been reported, such as carotid-superior cerebellar anastomosis (TEAL et al., 1972), carotid-anterior inferior cerebellar anastomosis (HAUGHTON et al., 1978., LASJAUNIAS et al., 1977., NUTIK and DILENGE, 1976., SCOTTI, 1975), and carotid-posterior inferior cerebellar anastomosis (CHAMBERS and LUKIN, 1975., DILENGE and HEON, 1974., KHODADAD, 1976., TEAL et al., 1973). In one patient reported by TEAL et al. (1972) an anastomotic vessel between the internal carotid artery and superior cerebellar artery was interpreted as a variant of the persistent trigeminal artery : whereas in his another case (TEAL, 1973), the origin of the posterior inferior cerebellar artery from the internal carotid artery was believed to represent a persistent hypoglossal artery. Also in the patients studied by KHODADAD (1976) and CHAMBERS and LUKIN (1975), the persistent trigeminal artery connected the internal carotid artery and posterior inferior cerebellar artery. A direct communication between the internal carotid artery and basilar artery was not found in either case.

We report a rare case of internal carotid-superior cerebellar anastomosis associated with cerebral aneurysms and an angiomatous malformation.

Case Report

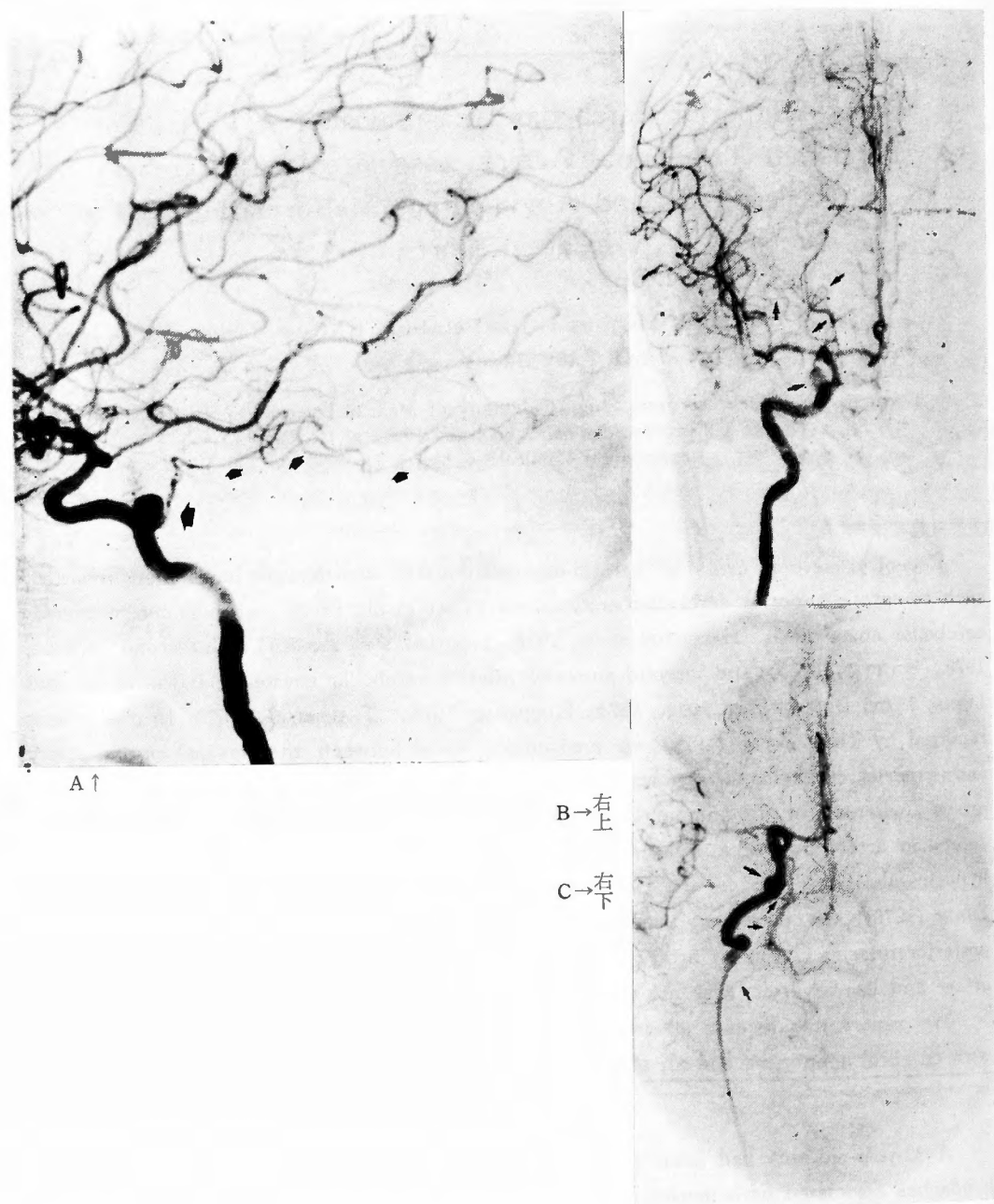
A 32-year-old lady had been in perfect health until she experienced suddenly severe headaches associated with nausea and vomiting. Her blood pressure was 170/110 mmHg and a spinal puncture yielded a bloody cerebro-spinal fluid.

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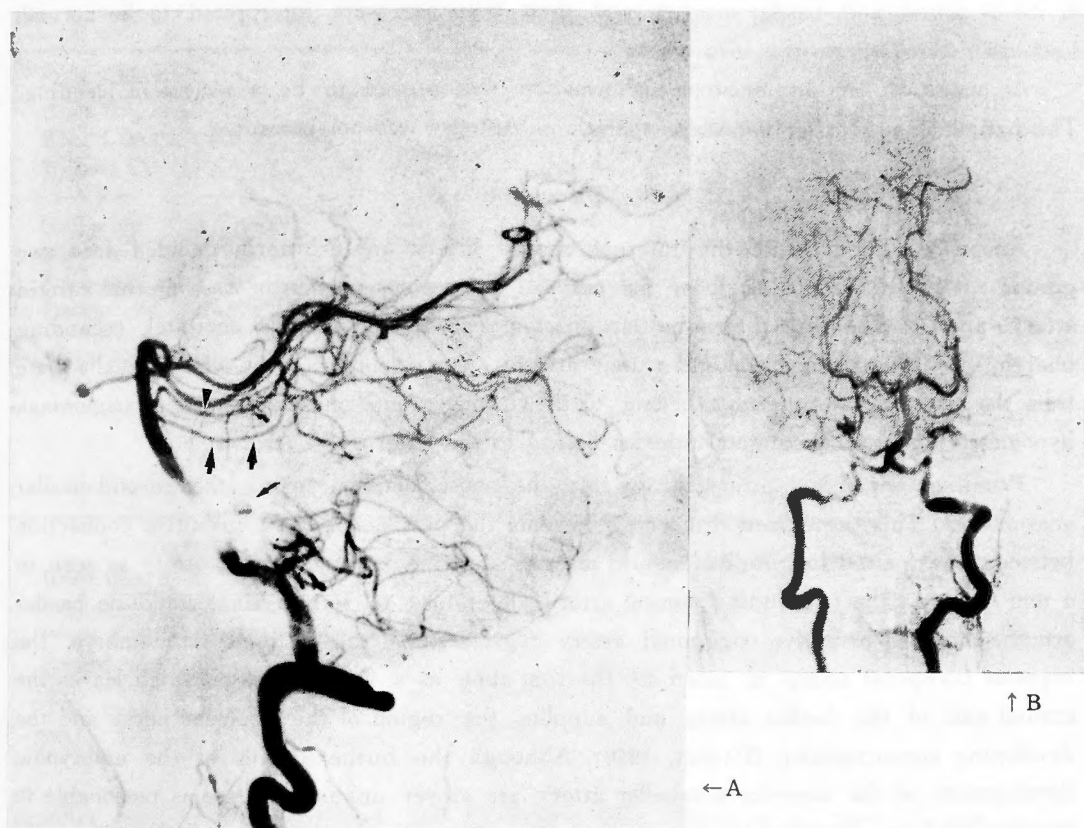
Key Words : Aneurysm, Arteriovenous malformation, Cerebral arteries, Anomaly, Primitive trigeminal artery, Subarachnoid hemorrhage.

索引語 : 脳動脈瘤, 脳動静脈奇形, 脳動脈, 一奇形, Primitive trigeminal artery, クモ膜下出血.

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**Fig. 1.** Selective right internal carotid angiogram. (A) Lateral projection. An anomalous origin of the marginal branch of superior cerebellar artery (arrows), and a saccular aneurysm at its origin from the internal carotid artery (large arrow) are contrast-filled. A smaller aneurysm at the origin of the posterior communicating artery is also shown. (B) and (C) anteroposterior and base views. Arrows indicate a course of the marginal branch of superior cerebellar artery on the right side.



**Fig. 2.** Left vertebral angiogram. (A) A main trunk of the right superior cerebellar artery is contrast-filled (arrows), but its marginal branch is not visualized. A normal left superior cerebellar artery (arrowhead) and an angiomatous malformation (small arrow) are seen. (B) An angiomatous malformation is seen to better advantage in this projection.

When admitted 4 hours later, physical and neurological examination was negative except for moderate nuchal stiffness. Computed tomography was non-contributory. Carotid and vertebral angiographies were performed through a femoral route.

A selective right internal carotid angiography revealed the following findings : (1) an anomalous anastomosis between the precavernous segment of the internal carotid artery and the right superior cerebellar artery, (2) a saccular aneurysm at the origin of this anomalous branch from the internal carotid artery, and (3) the second, smaller carotid aneurysm at the origin of the posterior communicating artery (Fig. 1 A, B, C).

A left vertebral injection disclosed a small angiomatous malformation fed by the right anterior inferior cerebellar artery associated with minimal vascular displacement suggesting a small hematoma in the right cerebellopontine angle region. A main trunk of the right superior cerebellar artery was contrast-filled, but its marginal branch which had been demonstrated previously by right internal carotid injection of the contrast medium could not be visualized despite repeated trials (Fig. 2 A, B). Otherwise, the size and configuration

of the vertebral and basilar arteries and their branches were interpreted to be normal. Left carotid angiogram was also normal.

At operation, an angiomatous malformation was proved to be a source of bleeding. The patient expired after two-stage operations. Autopsy was not permitted.

### Discussion

Anomalous branches of the internal carotid artery are arbitrarily divided into two groups : (1) branches arising from the cervical or petrous portion of the internal carotid artery, and (2) persistent carotid-basilar anastomosis. The anomalous occipital, ascending pharyngeal, internal maxillary and vidian arteries, and other branches which usually arise from the external carotid artery, belong to the former group, and the persistent trigeminal, hypoglossal, otic and proatlantal arteries belong to the latter.

Primitive trigeminal artery is by far the most common among the carotid-basilar anastomoses. This presegmental artery represents the persistence of a primitive connection between the paired longitudinal neural arteries and the internal carotid artery as seen in 4 mm embryo. The longitudinal neural arteries later fuse to form a single, midline basilar artery, and the primitive trigeminal artery regresses. In the 7 to 10 mm embryo, the superior cerebellar artery is noted for the first time as a definite vessel which leaves the cranial end of the basilar artery and supplies the region of the trochlear nerve and the developing metencephalon (PADGET, 1948). Although the further details of the embryonic development of the superior cerebellar artery are as yet unknown, it seems reasonable to suppose that any deviation from normal of the embryonic development of the vessels in this region may result in the superior cerebellar artery connected with the persistent trigeminal artery (TEAL, 1972).

Twelve patients with cerebellar artery supplied from the internal carotid artery have been reported. In the patient reported here as in the first case of TEAL et al. (1972), it seems most likely that the primary anastomosis between the internal carotid artery and the marginal branch of the superior cerebellar artery is being established by way of a variant of the persistent primitive trigeminal artery. In the present patient, however, there is no interposing segment of the basilar artery between the internal carotid artery and the superior cerebellar artery, and the basilar artery was not filled by internal carotid injection of the contrast medium.

Another feature of this patient is the association of cerebral arterial aneurysms and an angiomatous malformation. It has been well described that the persistence of primitive carotid-basilar anastomosis often accompanies other vascular anomalies (KARASAWA et al., 1972), but a simultaneous association of both aneurysm and angiomatous malformation in one patient as seen in the present case is apparently extremely rare.

An association of the persistent trigeminal artery and cerebral aneurysm is not uncommon. To our knowledge, however, the aneurysm arising from the junction of the primitive trigeminal artery and the internal carotid artery or basilar artery has been

**Table 1** Aneurysm arose from the Trigeminal Artery

| Author, year                  | Side           | Type        |
|-------------------------------|----------------|-------------|
| Davis RA, et al. (1956)       | unknown        | saccular?   |
| Bossi L & Caffaratti E (1963) | right          | saccular    |
| Wolpert SM (1966)             | right (case 1) | saccular    |
|                               | left (case 2)  | saccular*   |
| George AE et al. (1971)       | right          | saccular    |
| Morrison G et al. (1974)      | right          | fusiform**  |
| Enomoto T et al. (1977)       | right          | saccular*** |
| Present case (1978)           | right          | saccular    |

(\*) : at basilar junction

(\*\*) : trigeminal artery itself

(\*\*\*) : CCF caused by ruptured aneurysm

**Table 2** Trigeminal artery associated with infratentorial AVM

| Author, Year                      | Side of PTA | Side of AVM |
|-----------------------------------|-------------|-------------|
| Krayenbühl H & Yaşargil MG (1957) | right       | right       |
| Endo S et al. (1965)              | right       | right       |
| Perret G & Nishioka H (1966)      | right       | right       |
| Present case (1978)               | right       | right       |

PTA : Primitive trigeminal artery

AVM : Arteriovenous malformation

reported only in 6 cases (BOSSI and CAFFARATI, 1963., DAVIS et al., 1956., ENOMOTO et al., 1977., GEORGE et al., 1971., MORRISON et al., 1974., WOLPERT, 1966) (Table 1). Association of an arteriovenous malformation seems to be less frequent, eleven such cases having been reported. Among them, three were infratentorial arteriovenous malformation and all of them were found on the same side as the persistent trigeminal artery, but this artery did not feed the malformation (ENDO et al., 1965., KRAYENBÜHL and YAŞARGIL, 1957., PERRET and NISHIOKA, 1966) (Table 2). In one additional case, an anomalous anterior inferior cerebellar artery of the internal carotid origin supplied the carotid-cavernous sinus fistula (LASJAUNIAS et al., 1977).

Subarachnoid hemorrhage is often the initial clinical manifestation in such patients with multiple cerebral vascular anomalies. Each of an aneurysm, arteriovenous malformation, and occasionally the persistent embryonic carotid-basilar anastomosis itself has been blamed to be responsible for the bleeding episode. This fact poses an important problem in the clinical management of the individual patient.

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## 和文抄録

## 動脈瘤と動静脈奇形を合併した Carotid-SCA anastomosis の 1 例

—A variant of persistent trigeminal artery—

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Primitive trigeminal artery は, persistent carotid-basilar anastomoses の中で最も頻度も高く, その報告例も多くみられる. Teal (1972) らが persistent carotid-basilar anastomoses の variant type として, carotid-superior cerebellar artery anastomosis を報

告して以来, 12例の異型吻合が報告されているが, 本症例は, この variant type に動脈瘤と動静脈奇形を合併し, クモ膜下出血で発症した非常に稀な症例と思われたので文献的考察を加えて報告する.