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## An Anomalous Anastomotic Artery Between the Internal Carotid and Anterior Cerebral Arteries

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An arterial anomaly may represent the persistence of a vessel of major importance in the embryo, which disappears during the courses of development.

We recently observed a carotid-anterior cerebral anastomosis which coursed under the optic nerve to emerge between the optic nerves.

To date, only nine cases of an unusual anterior cerebral artery, which might be a variant form to the present case, have been reported arising from the internal carotid artery near the origin of the ophthalmic artery, and also passing under the optic nerve to emerge between the optic nerves<sup>2,4,6,8-10</sup>. But in these cases the anterior cerebral artery of usual origin was absent or hypoplastic. And there were other anomalies accompanied, such as hypoplasia of the internal carotid artery.

Studies of the development of cerebral arteries in animals<sup>6</sup>) and in man<sup>7</sup>) are referred and the possible origin of the anomalous vessel in the present case is discussed.

### Case report

A 56-year-old woman was admitted with a two-year history of dizziness and headache. Examination revealed no neurological abnormalities. The optic fundi and visual field appeared normal.

Plain skull radiographs showed that the right lesser wing of the sphenoid bone was slightly hypertrophic. Computed tomography (CT) showed a round mass of isodensity on the medial portion of the right lesser wing. The tumor was highly enhanced. Cerebral angiography

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Key Words: Cerebral arteries, Anomaly, Internal carotid artery, Anterior cerebral artery, Anastomosis.

索引語: 脳動脈, 異常, 内頸動脈, 前大脳動脈, 吻合.

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**Fig. 1.** Right carotid angiogram. An anomalous artery emerges from the intracavernous internal carotid artery (arrow).

through both of the internal and external carotid arteries showed no tumor opacification. The proximal portion of the right middle cerebral artery was elevated and stretched. From the internal carotid artery just proximal to the origin of the ophthalmic artery, an anomalous artery of fairly large caliber emerged and joined to the anterior cerebral-anterior communicating arterial junction (figs. 1, 2). The left internal carotid artery and vertebrobasilar system showed no abnormalities. Clinical diagnosis of sphenoidal ridge meningioma was made and the patient was taken to the surgery. At operation an extracerebral mass attached to the medial portion of the right sphenoidal ridge was totally removed. Pathological diagnosis was meningioma. After the removal of the tumor, an anomalous artery was found passing inferior to the right optic nerve, climbing up through prechiasmatic cistern, compressing the chiasm and joining to the anterior cerebral-anterior communicating arterial junction (figs. 3, 4). Postoperative CT scan showed complete removal of the tumor and the patient discharged without neurological deficit.

### Discussion

Anomalous arterial anastomoses may represent the persistence or enlargement of a channel normally found in the embryo. In the present case, it is thought that the anomalous artery may



**Fig. 2.** Right carotid angiogram. The anomalous artery courses medially to join the anterior communicating artery complex (arrow). The middle cerebral artery is elevated by the sphenoidal ridge meningioma (arrowheads).



**Fig. 3.** Photograph at operation. The anomalous artery emerges from the prechiasmatic space and compresses the chiasm.

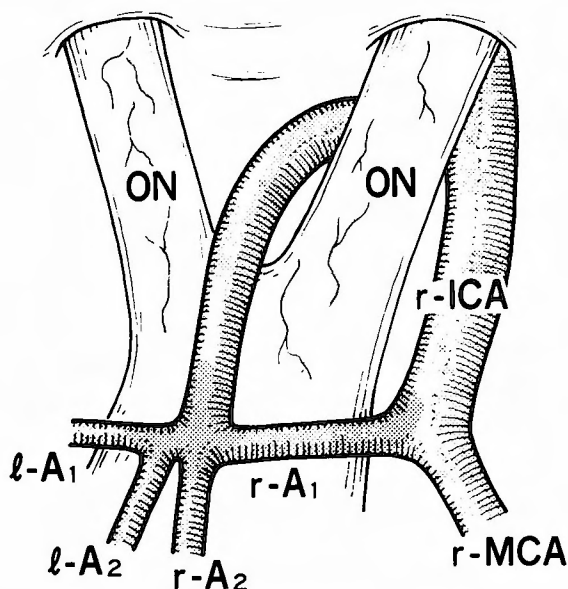


Fig. 4. Schematic drawing of Fig. 3.

also have arisen by enlargement of an anastomosis between branches of the internal carotid and anterior cerebral arteries which might be present in a certain stage of development.

According to Padget<sup>7)</sup>, at the 4-5 mm stage of embryo, just beyond the base of Rathke's diverticulum, the internal carotid artery gives off the primitive maxillary artery, which courses ventrally along the forebrain wall to the base of the optic vesicle. The artery is a relatively large and plays a major part in the supply of the cranial pole of the forebrain and the optic outgrowth. She stated that the primitive maxillary artery, although there are controversy for its naming<sup>2,3)</sup>, becomes incorporated in the formation of the inferior hypophysial artery.

Moffat studied the fate of the primitive maxillary artery in detail using rat's embryos<sup>6)</sup>. He stated that, in rat's embryo of 6-9 mm stage, the primitive maxillary artery begins to diminish in size and the cranial ramus of the internal carotid artery increases in size, and ends by passing ventrally into the region of the developing nasal cavity, forming the primitive olfactory artery. Then a new vessel appears in the plexus which lies between the two primitive olfactory arteries. This artery, described as the recurrent primitive olfactory artery, leaves the primitive olfactory artery at approximately right angle and runs medially and caudally to become continuous with the cranial end of the primitive maxillary artery. Usually the recurrent branch appears before the primitive artery has begun to diminish in size, so that these two vessels, together with the stem and cranial ramus of the internal carotid artery form a complete wide arterial circle "the peri-optic ring" around the base of the optic stalk. Such a peri-optic ring is shown in embryos 7 mm stage in his paper.

On the other hand, in Padget's paper and in her figure 3<sup>7)</sup>, which shows a 5.5 mm human embryo, a large primitive maxillary artery, together with what appears to be a small recurrent branch of the primitive olfactory artery, also forms such an arterial ring around the optic stalk.

Thus, the peri-optic arterial ring described by Moffat may be present not only in rat's embryo but also in human embryos in the relatively early stage of development.

There are nine other cases in the literature in which the anomalous anastomosis is apparent<sup>2,4,6,8-10</sup>. In these cases, the anomalous vessel appears to replace the function of the proximal anterior cerebral artery. And the incidence of associated saccular aneurysms and other congenital vascular anomalies is high.

In the present case, the anterior part of the circle of Willis was complete and no other anomalies were found except the anastomotic vessel between the intracavernous portion of the internal carotid artery and the anterior cerebral artery. The internal carotid and the proximal portion of the anterior cerebral artery, together with this anomalous artery completes the circle around the optic nerve. Thus, we propose the term "presistent peri-optic arterial ring" for such an anomaly.

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## 和文抄録

## 内頸動脈—前大脳動脈間異常吻合動脈を有した 1 例

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髄膜腫を有する56才女性例において，頭蓋内内頸動脈と前大脳動脈間に異常吻合動脈を認めた．異常血管は内頸動脈海綿静脈洞部より発し，視交叉の前方を上行し，視交叉から前交通動脈—前大脳動脈接合部に合流していた．同様の異常吻合血管例は過去9例の報告があるが，通常，内頸動脈あるいは前大脳動脈が欠損あるいは低形成で，異常血管が副血行路として重要な

役割をはたしている．本例においては，異常血管が正常内頸動脈，正常前大脳動脈と共に視神経をとりかこむように存在している．このような異常血管と内頸，前大脳動脈によって形成される動脈輪に対して，発生学的考察から“persistent perioptic arterial ring”という呼称を提唱した．