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Anomalous Arterial Supply of Temporal and Occipital Lobes by Anterior Choroidal Artery: Angiographic Study

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Anomalous arterial supply to the temporal and occipital lobes was studied retrospectively in 320 patients with 640 bilateral carotid angiograms. An unusual artery arising from the supraclinoid part of the internal carotid artery was identified in seven angiograms (six patients). Proximally, this artery takes the same course as the cisternal segment of the anterior choroidal artery, gives rise to the choroidal branch to the choroid plexus of the lateral ventricle, and then supplies the medial and inferior parts of the temporal and occipital lobes. It was concluded that this artery represents anomalous development of the anterior choroidal artery, having large temporal and occipital branches that supply the medial and inferior parts of the temporal and occipital lobes.

The medial and inferior parts of the temporal and occipital lobes are usually supplied by the cortical branches of the middle and posterior cerebral arteries. The anterior choroidal artery usually gives rise to small arterial branches supplying the uncus, pyriform cortex, amygdaloid nucleus, and hippocampal gyrus [1–6]. Occasionally the anterior choroidal territory and part of the posterior cerebral artery territory are supplied by one artery originating from the internal carotid artery [2, 6, 7]. This has been considered a branch of the anterior choroidal artery, supplying the temporal lobe [2, 6, 7], or an anomalous temporal artery originating directly from the internal carotid artery [7]. We undertook a retrospective study to define this variation more clearly.

Materials and Methods

We reviewed 640 carotid angiograms (320 patients) and 280 accompanying vertebral angiograms. In five patients, a single anomalous artery was identified arising from the supraclinoid part of the internal carotid artery to supply varying parts of the occipital or temporal lobes as well as the territory normally supplied by the anterior choroidal artery. In one patient, the artery was paired.

The angiograms of each person having such an anomalous artery were scrutinized for the territory of blood supply, for choroidal branches arising from this artery and supplying the choroid plexus of the trigone of the lateral ventricle, and for any additional branch from the supraclinoid part of the internal carotid artery. The development of the temporal branches arising from the middle and posterior cerebral arteries, the development of the posterior communicating and posterior cerebral arteries, and any associated vascular anomalies were also evaluated.

Results

Seven (1.8%) of the 640 carotid angiograms revealed six patients with this anomalous artery (table 1). In all cases the proximal course of this vessel was that of the anterior choroidal artery (figs. 1A–1D, 2A, and 2B). Varying parts of the temporal and occipital lobes, usually the medial and inferior parts, were supplied by this artery.

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TABLE 1: **Summary of Angiographic Findings**

Case No.	Age, Gender	Clinical Diagnosis	Side	Other Arteries Supplied	Size of:			
					Choroidal Branches	Posterior Communicating Artery	Temporal Branches, PCA	Calcarine Artery, PCA
1	53, M	Organic psychosis	Right; left	PTA	Small; normal	Small; none	Small; small	Normal; normal
2	18, M	Epilepsy	Left	PTA	Normal	Small	Small	Normal
3	43, F	Aneurysm, ICA	Right	PTA, calcarine	Normal	None	Small	Small
4	27, M	Epilepsy	Left	PTA, calcarine	Normal	Small	Normal	Small
5	27, M	Eales disease	Left	PTA	Small	None	*	*
6	32, M	Head trauma	Left	PTA, calcarine	Small	None	*	*

Note.—In no cases did other arteries arise from the internal carotid artery. The size of the main posterior cerebral artery was normal in all cases (vertebral angiograms were not obtained in cases 5 and 6). The size of the temporal branches of the middle cerebral artery was normal in all cases. PCA = posterior cerebral artery; PTA = posterior temporal artery; ICA = internal carotid artery.

* Vertebral angiogram not obtained.

In the seven angiograms this vessel was the only visible major artery, besides the posterior communicating artery, originating from the supraclinoid part of the internal carotid artery. Thus no other artery simulated the course of the anterior choroidal artery.

A small branch of this artery supplied the choroid plexus of the lateral ventricle in three instances, and a relatively large branch, the size of the usual anterior choroidal artery, supplied it in four. This artery supplied the territory of the posterior temporal artery in four patients (figs. 1A and 1B) and that of the posterior temporal and calcarine arteries in the other three (figs. 2A and 2B).

The posterior communicating artery was not visible in four of the seven angiograms with this anomalous artery, and in three angiograms it was small. The posterior cerebral artery was normally developed in five. The temporal branches of the middle cerebral artery were normal in size in all seven angiograms.

Vertebral angiograms were obtained in four patients, including the one patient with an anomalous artery bilaterally. In four angiograms, the temporal branches of the posterior cerebral artery were poorly developed on the side of the anomalous artery (figs. 1E and 2C). In one, the temporal branches were of a normal caliber. The calcarine branches of the posterior cerebral artery were small in two of three patients with supply of the territory of the calcarine artery by this anomalous artery (fig. 2C). In the third patient, a vertebral angiogram was not obtained.

No anastomoses were demonstrated between the anomalous artery and the posterior communicating, posterior cerebral, or posterior choroidal arteries. In a few patients, a small branch arose from the cisternal part of the anomalous artery, extending inferiorly to the region of the uncus.

These findings strongly suggest that the anomalous artery is actually an anomalously large anterior choroidal artery supplying the medial and inferior parts of the temporal lobe and occasionally the occipital lobe. This anomalous artery was associated with an aneurysm at its origin in case 3.

Discussion

Although there are several reports of an anomalous artery arising from the supraclinoid part of the internal carotid artery to supply the medial and inferior parts of the temporal lobe [7], there are no detailed anatomic and angiographic studies. From autopsy specimens Theron and Newton [6] sometimes found an abnormally enlarged anterior choroidal artery supplying the uncus of the temporal lobe. Goldberg [2] and Hoyt et al. [7] also described an anomalous posterior temporal artery arising from the anterior choroidal artery.

It is well known that the anterior choroidal artery gives rise to small temporal branches that supply the anterior medial part of the temporal lobe, mainly the piriform cortex, the uncus, and the amygdaloid nucleus [1–6]. The hippocampal gyrus and the dentate gyrus of the temporal lobe may be supplied partly by the anterior choroidal artery [2, 3, 5].

The cortical branches of the posterior cerebral artery supply the uncus, hippocampal gyrus, and other areas that also receive blood supply from the anterior choroidal artery [8, 9]. It has been stated that the branches of the anterior choroidal, the posterior communicating, and middle and posterior cerebral arteries anastomose abundantly over the surface of the temporal lobe [2, 6, 8]. There is a reciprocal relation between the territories supplied by these vessels, and the region supplied by the anterior choroidal artery varies and depends greatly on the development of the posterior cerebral arteries [2]. The anterior choroidal artery may be enlarged if the temporal branches of the posterior cerebral artery are hypoplastic. Because of this reciprocal relationship, some may consider these arteries anatomic variants rather than vascular anomalies.

Although the true nature of this anomalous artery is not exactly understood, we have concluded that it is possibly an enlarged anterior choroidal artery supplying temporal and occipital parts of the temporal lobe and occasionally the territory of the calcarine artery. This conclusion is supported by the following angiographic findings: (1) the course of the proximal part of this artery is the same as that of the cisternal part of the anterior choroidal artery; (2) this artery gives rise to the choroidal branch, which supplies the choroid plexus of the trigone; (3) there is no other artery from the supraclinoid part of the internal carotid artery; and (4) the temporal and/or calcarine branches of the posterior cerebral artery are absent or hypoplastic.

An anomalous posterior temporal artery may arise directly from the internal carotid artery [7]. If the choroid branch is not seen, there is no way of distinguishing it from the anomalous anterior choroidal artery described in this report. Occasionally the choroidal branch may not be seen in

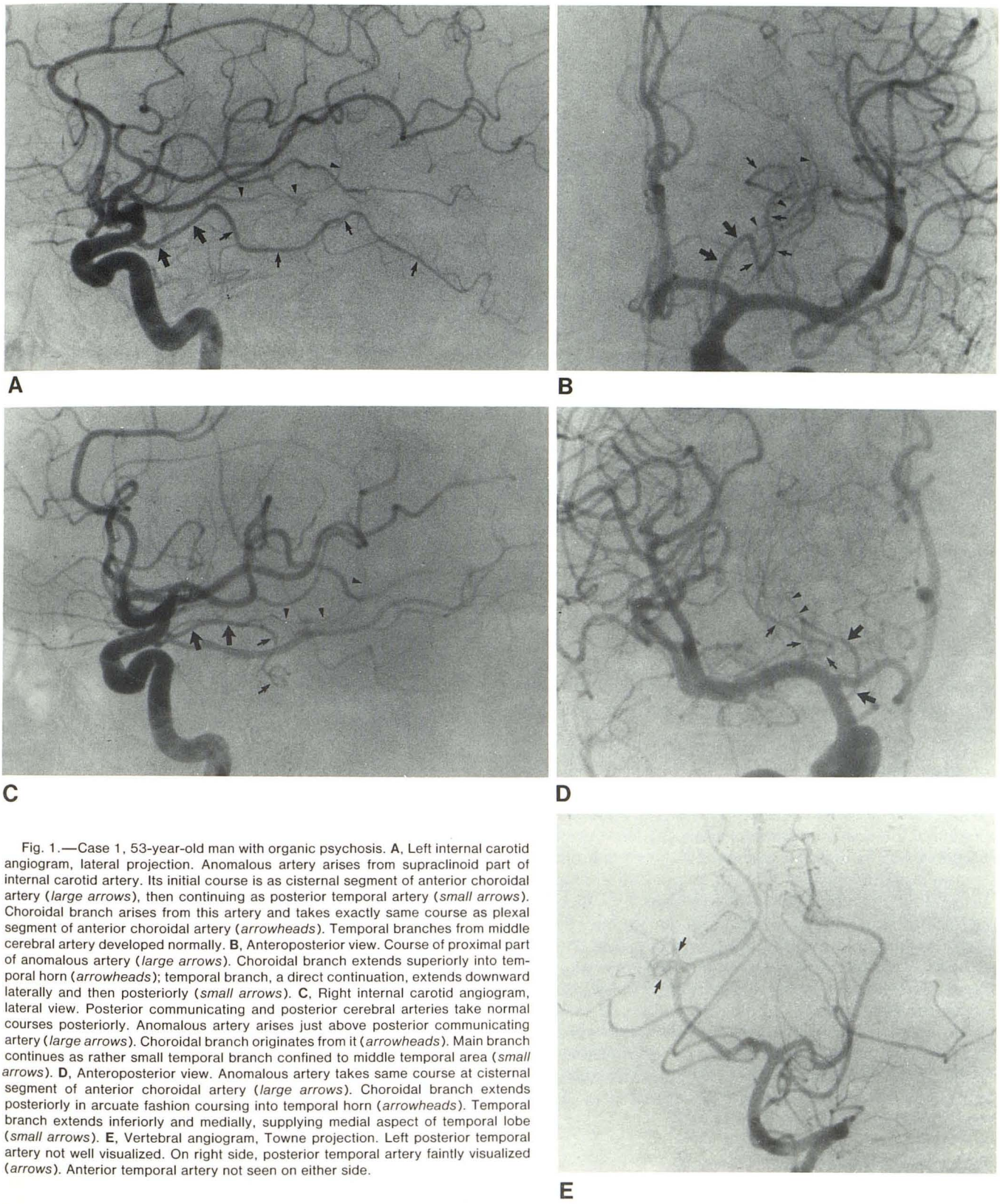
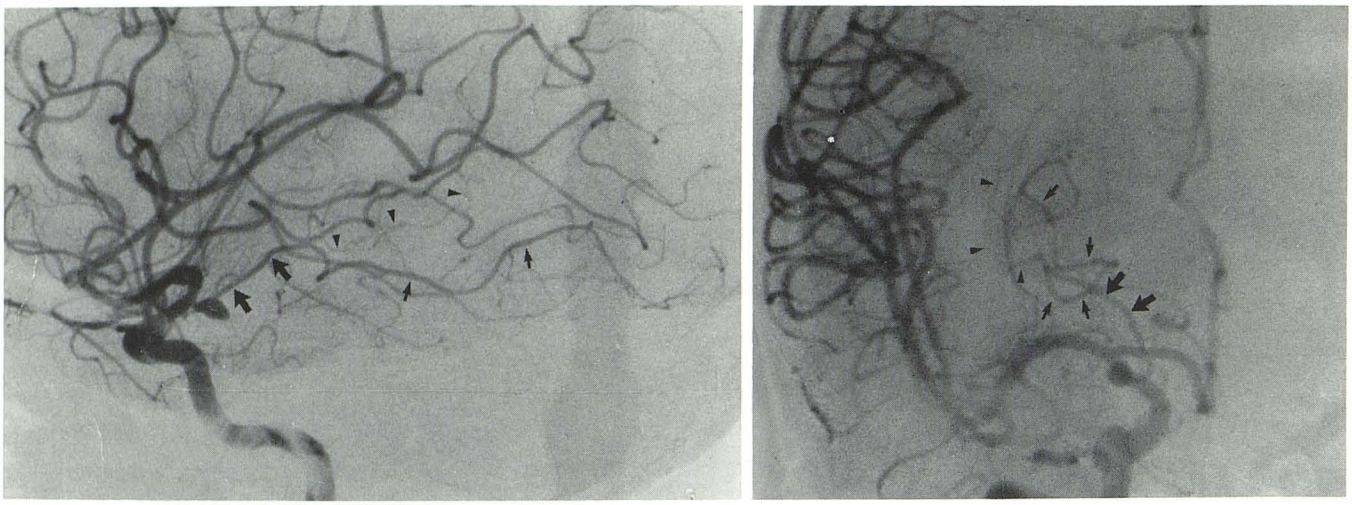


Fig. 1.—Case 1, 53-year-old man with organic psychosis. **A**, Left internal carotid angiogram, lateral projection. Anomalous artery arises from supraclinoid part of internal carotid artery. Its initial course is as cisternal segment of anterior choroidal artery (*large arrows*), then continuing as posterior temporal artery (*small arrows*). Choroidal branch arises from this artery and takes exactly same course as plexal segment of anterior choroidal artery (*arrowheads*). Temporal branches from middle cerebral artery developed normally. **B**, Anteroposterior view. Course of proximal part of anomalous artery (*large arrows*). Choroidal branch extends superiorly into temporal horn (*arrowheads*); temporal branch, a direct continuation, extends downward laterally and then posteriorly (*small arrows*). **C**, Right internal carotid angiogram, lateral view. Posterior communicating and posterior cerebral arteries take normal courses posteriorly. Anomalous artery arises just above posterior communicating artery (*large arrows*). Choroidal branch originates from it (*arrowheads*). Main branch continues as rather small temporal branch confined to middle temporal area (*small arrows*). **D**, Anteroposterior view. Anomalous artery takes same course at cisternal segment of anterior choroidal artery (*large arrows*). Choroidal branch extends posteriorly in arcuate fashion coursing into temporal horn (*arrowheads*). Temporal branch extends inferiorly and medially, supplying medial aspect of temporal lobe (*small arrows*). **E**, Vertebral angiogram, Towne projection. Left posterior temporal artery not well visualized. On right side, posterior temporal artery faintly visualized (*arrows*). Anterior temporal artery not seen on either side.



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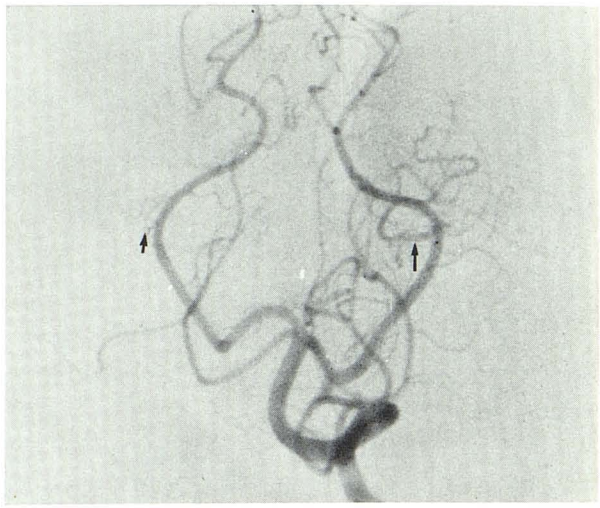

C

Fig. 2.—Case 3, 43-year-old woman with aneurysm of supraclinoid part of internal carotid artery. **A**, Right internal carotid angiogram, lateral view. Anomalous artery arises from supraclinoid part of internal carotid artery (*large arrows*), extends posteriorly, and supplies territory of posterior temporal and calcarine arteries (*small arrows*). Small choroidal branch arises and courses posteriorly and superiorly within temporal horn (*arrowheads*). Saccular aneurysm arises from origin of anomalous artery. Posterior communicating artery not visualized. **B**, Anteroposterior view. Proximal part of anomalous artery (*large arrows*) and saccular aneurysm at origin. Temporal branch extends inferiorly, medially, and then posteriorly, supplying temporal lobe (*small arrows*). Choroidal branch courses posteriorly in arcuate fashion (*arrowheads*). **C**, Vertebral angiogram, Towne view. Normally developed left posterior temporal artery (*long arrow*). Hypoplastic right posterior temporal artery (*short arrow*).

patients with the anomalous anterior choroidal artery. The absence of the choroidal branch does not necessarily conflict with our conclusion, as long as the other criteria are met.

The choroidal branch of the anomalous choroidal artery could be considered as the lateral posterior choroidal artery arising from an anomalous temporal artery, since the posterior choroidal artery occasionally arises from the temporal branch of the posterior cerebral artery [9]. However, this is probably not the case in our material, since the proximal course of the anomalous artery takes the usual course of the anterior choroidal artery and is different from that of the lateral posterior choroidal artery. Moreover, the vertebral angiograms always showed the lateral posterior choroidal arteries. Furthermore there were no other internal carotid branches besides this anomalous artery and the posterior communicating artery.

The incidence of this anomaly has not been reported in the anatomic or angiographic literature. We detected it in 1.1% of 640 carotid angiograms. No other vascular anomalies were discovered; apparently it occurs as an isolated developmental variation.

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