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Anomalous Branching of the Left Common Carotid Artery with Associated Atherosclerotic Changes: A Case Report

Robert E. Lambiase,[1] Richard A. Haas,[1] Wilfred I. Carney, Jr.,[2] and Jeffrey Rogg[1]

Numerous anatomic variants of the internal and external carotid arteries have been described [1–6]. We report on an unusual variant of external carotid artery anatomy in which no identifiable main external carotid trunk was present, and thus no true carotid bifurcation existed. The bifurcation as it existed was reduced to anomalous branching of a common facial-lingual trunk. Marked atherosclerotic plaque had developed in the absence of turbulent flow, at the site of baroreceptor incorporation.

Case Report

A 76-year-old man presented with a 6-week history of episodic confusion and a sensation he described as "being behind a screen." However, he denied visual symptoms. No focal neurologic deficits were elicited on physical examination. The patient had no significant medical history, and was on no medications. A noncontrast CT scan of the head demonstrated mild generalized cerebral atrophy, a probable old left occipital infarct, and several bilateral deep white matter lacunar infarcts. An outside carotid Doppler study was interpreted as showing a high-grade left internal carotid artery stenosis. No mention was made of the external carotid artery. The patient underwent carotid angiography prior to possible carotid endarterectomy. Angiography revealed a normal origin of the left common carotid artery off the aortic arch. A tight stenosis of the common carotid artery was demonstrated at the level of the anticipated carotid bifurcation (C3–C4); however, no main external carotid trunk was visualized (Fig. 1). A diminutive calibered superior thyroidal artery arose within the distal common carotid plaque. Several centimeters distally was the origin of a vessel that was analogous to a common facial-lingual trunk. The internal maxillary artery arose independently, approximately 1 cm distal to the facial-lingual trunk take-off. It gave origin to its expected branches, including the middle meningeal artery. The superficial temporal artery originated at the medial bend of the internal maxillary artery. No occipital artery was identified. Note was made of atherosclerotic changes of the supraclinoid portion of the left internal carotid artery.

Injection of the right common carotid artery, other than for lack of an occipital artery, demonstrated normal internal and external carotid artery anatomy.

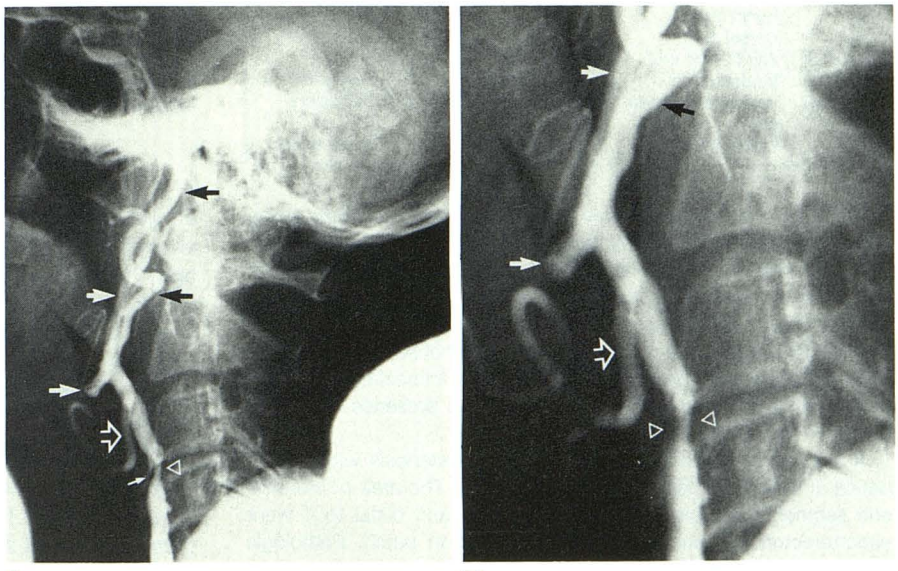

Fig. 1.—*A* and *B*, Lateral selective left common carotid arteriogram (*A*) and close up (*B*) show facial-lingual trunk (*open arrow*) and internal maxillary artery (*larger white arrows*) arising directly and independently off the internal carotid artery (*black arrows*), which partially overlies the internal maxillary artery in this projection and is tortuous in its cervical course. The middle meningeal and superficial temporal arteries arise as branches of the internal maxillary artery in the normal fashion (not well shown on this film). The diminutive superior thyroidal artery is barely visible (*small white arrow*). Note the extensive atheroma (*arrowheads*) at the anticipated site of the carotid bifurcation, although no bifurcation existed in this patient.

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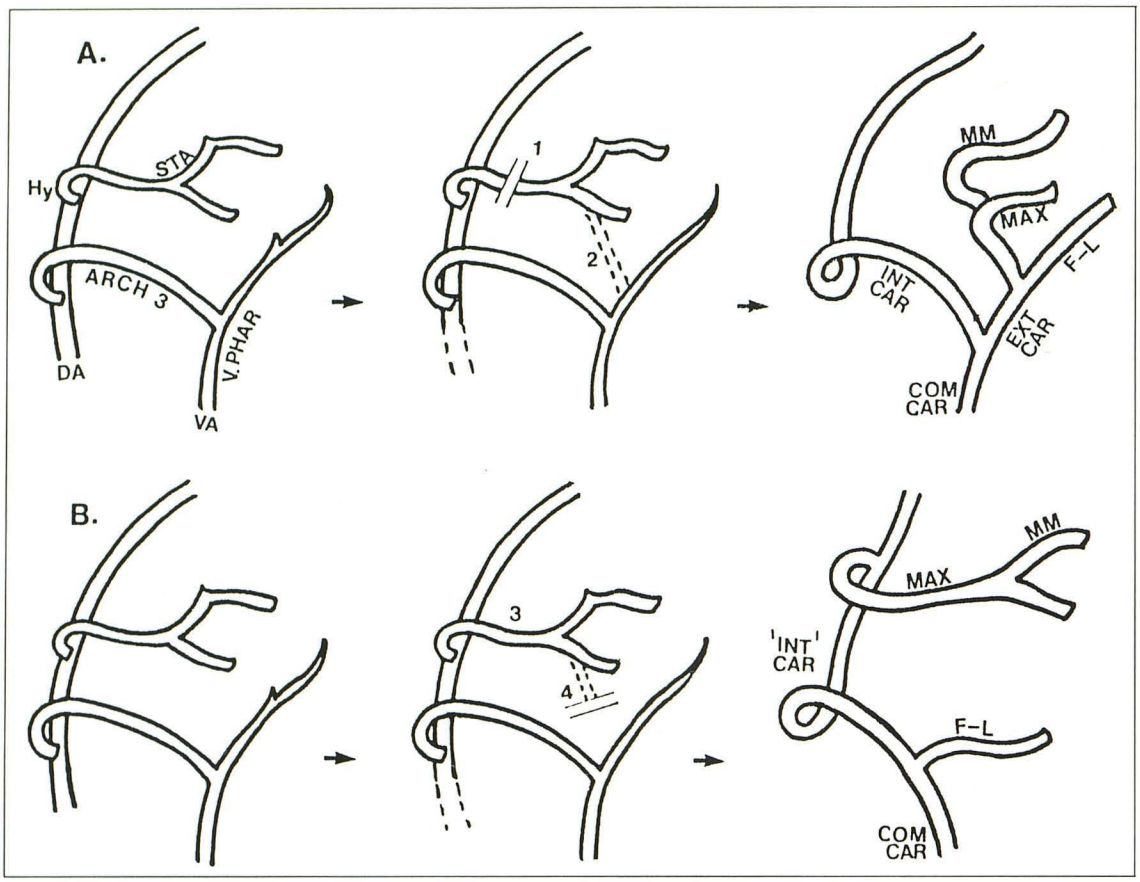
[1] Department of Diagnostic Imaging, Brown University Program in Medicine, 593 Eddy St., Providence, RI 02902. Address reprint requests to R. E. Lambiase.
[2] Department of Vascular Surgery, Brown University Program in Medicine, Providence, RI 02902.



Key to Abbreviations in Figure 2

Hy	Hyoid artery	MM	Middle meningeal artery
DA	Dorsal aorta	MAX	Internal maxillary artery
ARCH 3	Third aortic arch	F-L	Facial-lingual trunk
VA	Ventral aorta	EXT CAR	External carotid artery
V. PHAR	Ventral pharyngeal artery	INT CAR	Internal carotid artery
STA	Stapedial artery	COM CAR	Common carotid artery

Fig. 2.—*Top row*, Presumed normal embryology of internal-external carotid differentiation.

***Bottom row*, Speculative embryogenesis of the case presented.**

Note the normal proximal regression of the hyoid artery (1) and the transfer of its branches to the developing external carotid system (2). In *B*, note the postulated failure of the proximal hyoid artery to regress (3), thus forming an abnormal branch off the internal carotid artery. There is also failure of the hyoid artery to transfer its branches (4), presumably because of a lack of proximal regression. This in essence reduces the external carotid artery to a facial-lingual trunk.

At left carotid endarterectomy, the small superior thyroidal artery and the common facial-lingual trunk were identified. Exposure of the main carotid artery trunk confirmed the absence of a separate internal and external carotid artery bifurcation. Intraoperative palpation of the stenotic carotid artery segment (at the anticipated site of the carotid bifurcation) resulted in a pronounced vagal response, with bradycardia and a moderate drop in blood pressure, that immediately reversed with cessation of palpation. This indicated the presence of baroreceptors at the level of the carotid artery plaque.

Arteriotomy revealed a high-grade smooth stenosis without evidence of subintimal hemorrhage or ulceration. The area of stenosis and segments approximately 3 cm proximal and distal to it were endarterectomized and patched with a Dacron patch. Pathologic analysis of the endarterectomized specimen revealed typical atheroma without ulceration or recent hemorrhage.

Discussion

Multiple anomalies of the carotid artery sytem have been documented, including aberrant internal carotid branches, duplications, and segmental agenesis of the internal carotid artery. Anomalies of the external carotid artery and its branches are less common and less consistent. A recent case report describes a patient with anomalous anatomy very similar to that reported here, but without associated atherosclerotic changes [7]. The embryology of the external carotid artery is extremely complex and incompletely understood. The interested reader is referred to detailed sources [6, 8, 9]. The embryogenesis of the anomaly presented here is necessarily speculative (Fig. 2), but could conceivably arise as a result of a lack of regression of the hyoid artery; the persistent hyoid artery subsequently serving as the anomalous branch giving rise to the internal maxillary artery directly from the internal carotid artery and perhaps accounting for the redundant proximal loop of this branch noted on angiography. Lack of transfer of the stapedial artery and distal hyoid artery to the ventral pharyngeal artery would in essence reduce the future external carotid trunk to the common facial-

lingual trunk. The carotid bifurcation as such would be represented solely by the branching of the facial-lingual artery.

Of interest in this particular case is the development of extensive atheroma at the anticipated site of the carotid bifurcation. The typical carotid bifurcation is a site rich in chemo- and baroreceptors. That baroreceptors existed in this segment of our patient's carotid artery was demonstrated by vagal response to direct palpation at surgery. In this case, turbulent blood flow would not be expected at the site of the atheroma development, as no significant arterial branching occurred at this site. Thus, it is difficult to invoke turbulent blood flow as a predisposing factor to the development of atherosclerosis in this instance. Speculation would suggest that perhaps focal atherosclerosis at this site related instead to local histologic changes in the artery; either to an abrupt thinning of the media as is typically encountered as the common carotid artery gives rise to the carotid bulb and progresses as the internal carotid artery, or to histologic differences related to the incorporation of chemo- and baroreceptors in this segment of the artery.

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