The anomaly of a non-bifurcating cervical carotid artery

Case report

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A case of a rare developmental anomaly of the cervical carotid artery is reported. In this patient the non-bifurcating carotid artery gave origin to all of the branches normally supplied by the external carotid artery and thereafter continued as the internal carotid artery. Embryological events responsible for this anomaly are briefly discussed.

KEY WORDS • carotid artery • internal carotid artery • developmental anomaly • embryoology

The common carotid artery bifurcation usually lies at the level of the C-4 vertebra or the upper border of the thyroid cartilage, but it may occur as low as the level of the T-3 vertebra or as high as the hyoid bone. In a few instances the common carotid artery has been found to be absent; instead, the external and internal carotid arteries arise directly from the innominate artery or the aortic arch. It is extremely rare that the common carotid artery ascends in the neck without undergoing bifurcation. The authors present such a case in which the non-bifurcating left carotid artery gave origin to all branches normally given off by the external carotid artery and subsequently constituted the internal carotid artery (ICA).

Case Report

This 55-year-old diabetic woman suddenly developed ptosis of her left eyelid and double vision on the evening of June 5, 1988. She visited an ophthalmologist on the following day, and was referred to us for evaluation of possible intracranial lesions. Physical examination revealed thrombophlebitis in both legs. Her pupils were equal and reactive to light. She had ptosis of the left eyelid. She could not adduct her left eye, resulting in double vision on the right lateral gaze. The remainder of the neurological examination was unremarkable. On laboratory investigations glucose tolerance was abnormal, with a fasting blood glucose level of 260 mg/dl. Skull x-ray films and computerized tomography scans of the head and eye showed no abnormalities.

In order to rule out a cerebral aneurysm, left carotid and vertebral angiography was performed through the femoral route on June 17. The left common carotid artery was seen to ascend in the neck without undergoing division (Figs. 1 and 2). From this single artery originated all of the branches that are normally supplied by the external carotid artery. Thereafter, the artery continued as the ICA, and entered the cranial cavity after reaching the base of the skull. The intracranial portion of the left carotid and vertebral angiograms was normal.

Paresis of the patient's left external ocular muscles was thought to be due to diabetic oculomotor palsy. The symptoms improved with control of the diabetes mellitus.

Discussion

Embryologically, the ICA is formed from the third aortic arch and the dorsal aorta cranial to it, and con-
Non-bifurcating cervical carotid artery

Fig. 1. Left carotid angiograms, slightly oblique (left) and lateral (right) views, demonstrating the non-bifurcating cervical carotid artery which gives origin to all of the branches of the external carotid artery and continues as the internal carotid artery.

Continues forward as a vessel separate from the capillary plexus extending to the walls of the forebrain and midbrain. The external carotid artery arises as a new branch from the ventral aspect of the third arch artery. The branches of the external carotid are formed from a capillary network with which vascular buds from the neighboring arteries become connected. As a rule the cervical portion of the ICA yields no branches, with the exception of the inferior pharyngeal artery. In a rare instance, vascular buds are given off not by the external carotid artery but by the third aortic arch. This vascular misdirection results in anomalous branches coming off the ICA. There are several reports describing an origin in the ICA of one or two of the following arteries: ascending pharyngeal artery, occipital artery, posterior inferior cerebellar artery, and posterior meningeal artery.

It is extremely rare, however, that all of the branches normally supplied by the external carotid artery originate from a non-bifurcating carotid artery as seen in the present case. Two previous reports that may help in understanding the mechanism of the developmental anomaly in our case are quoted below. In 1965, Seidel described a patient in whom the distal portion of the external carotid artery was obliterated and all of its branches arose from the ICA. In that case, the external carotid artery with a blind end ran dorsolateral to the ICA. Nishizawa, et al., reported a case of agenesis of the proximal portion of the right ICA, in which the ICA was occluded shortly after bifurcation of the common carotid artery, and the extremely dilated external carotid artery continued to the distal portion of the ICA at the level of the C-2 vertebra. They speculated that the third aortic arch might have been maldeveloped and that the distal portion of the dorsal aorta might have received collateral circulation via the persistent first or second aortic arch. In those two cases, the carotid artery on the contralateral side was not studied.

In our case, the common carotid artery had no bifurcation in the neck. Thus, it is difficult to determine whether the artery with branches is the ICA or the external carotid artery. Two interpretations are possible. One is agenesis of the main trunk of the external carotid artery, as described by Seidel. All of the branches normally supplied by the external carotid artery were eventually given off by the ICA in our case. A somewhat tortuous course of the ICA at the upper cervical region is to be ascribed to atherosclerosis associated with diabetes mellitus. This anomaly may be explained embryologically as follows. The new outgrowth from which the external carotid artery would have formed did not arise. Hence, all of the branches of the external carotid artery were connected with vascular buds from the third aortic arch or dorsal aorta. The other interpretation of this developmental anomaly is agenesis of the most proximal segment of the ICA. In this situation, the common carotid artery continued to the external carotid artery which provided the usual branches. The distal end of the external carotid artery ran posterosomedially and continued to the distal portion of the ICA at the level of the C-1 vertebra. According to this interpretation, the embryological mechanism of this anomaly is maldevelopment of the third aortic arch. The course of the carotid artery in the present case is similar to that of Nishizawa, et al., except for the absence of the arterial stump. Therefore, we are in favor of the latter interpretation.


Fig. 2. Left carotid angiogram, lateral view (left), and its schematic drawing (right) showing the anatomy of the non-bifurcating carotid artery and its branches.
References


