Persistent proatlantal artery with carotid-vertebral anastomosis

Case report

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The authors describe the occurrence of proatlantal artery as an incidental angiographic observation in a young Indian soldier. This primitive anastomotic channel is seen extending from near the origin of the external carotid artery to the suboccipital region, traversing the foramen magnum and coursing beyond like a vertebral artery. The developmental and roentgenological aspects of carotid-basilar and carotid-vertebral anastomosis are discussed, along with a review of four similar cases reported previously.

KEY WORDS • persistent proatlantal artery • external carotid origin • carotid-vertebral anastomosis

At an early 4-mm embryonic stage, the entire developing brain is supplied by the primitive carotid arterial system. Later, at the 7- to 12-mm stage, the vertebral arteries develop to take over the supply to the vertebrobasilar territory. In this transitional period, a supplementary blood supply is carried by some transient anastomotic arteries. These channels in cranio-to-caudal sequence are the cranial extension of the internal carotid artery (ICA), and primitive trigeminal, otic, hypoglossal, and proatlantal arteries.

The cranial extension of the ICA becomes the posterior communicating artery and the rest are obliterated, first the otic, followed by the hypoglossal and finally the trigeminal artery. Until the vertebral system fully takes over, the caudal part of the developing basilar artery is supplied by the proatlantal artery for a few critical days.

Of these five temporary vessels, a persistent origin of the posterior cerebral artery direct from the ICA and the persistent trigeminal artery are two abnormalities which may be frequently observed. The latter vessel is seen coursing between the ICA as it enters the cavernous sinus and the rostral part of the basilar artery. The primitive otic artery passes through the internal acoustic meatus and connects the intrapetrous part of the ICA and caudal portion of the basilar artery.

The persistent hypoglossal artery arises as a robust branch from the cervical part of the ICA at the C2-3 level, follows a tortuous course through the anterior condyloid foramen (not the foramen magnum) to join the caudal part of the basilar artery, and
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Fig. 1. Frontal (left) and lateral (right) angiographic projections, showing the intracranial branches of the anomalous vessel corresponding to those of normal vertebral and basilar arteries, and an extensive vascularized sellar mass.

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Origin*</th>
<th>Nomenclature Used</th>
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<tbody>
<tr>
<td>Gottschau, 1885</td>
<td>ICA</td>
<td>anatomical description of an “abnormal vessel”</td>
</tr>
<tr>
<td>Conforti, et al., 1966</td>
<td>ICA</td>
<td>anomalous carotid-vertebral anastomosis; primitive cervical segmental artery</td>
</tr>
<tr>
<td>Lie, 1972</td>
<td>ICA</td>
<td>“proatlantal artery”</td>
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<tr>
<td>Lucca Relli &amp; De Farrari, 1960</td>
<td>ECA</td>
<td>anomalous origin of lt. vertebral a. from ECA</td>
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<tr>
<td>Hackett &amp; Wilson, 1968</td>
<td>ECA</td>
<td>congenital external carotid vertebral anastomosis</td>
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<tr>
<td>Samra, et al., 1969</td>
<td>ECA</td>
<td>persistent primitive hypoglossal artery</td>
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<tr>
<td>Surya Rao &amp; Sethi, 1975</td>
<td>ECA</td>
<td>“proatlantal artery”</td>
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* ICA = internal carotid artery; ECA = external carotid artery.

might be associated with an absent posterior communicating artery. The persistent proatlantal artery arises similarly from the ICA, and ascends obliquely in the upper lateral part of the neck to reach the suboccipital region. There it connects with the horizontal portion of the vertebral artery as it lies over the posterior arch of the atlas, traverses the foramen magnum and behaves beyond it as a normal vertebral artery. This transient shunt vessel starts regressing at the 7- to 12-mm stage of the embryonic development and disappears when the embryo reaches 12 to 14 mm. This vessel may originate either from the cervical ICA or the external carotid artery.7

Case Report

This 23-year-old man presented with deterioration of vision in his left eye. On left carotid angiography, a large, rapidly growing sellar mass was found. A sizable vessel was seen branching obliquely from near the origin of the external carotid artery. This abnormal vessel ascended the upper lateral part of the neck to the suboccipital region, and entered the cranial cavity by the foramen magnum (Fig. 1).
Discussion

In 1954, Padget,9 while discussing the nomenclature of the embryonic intersegmental vessels, specifically gave the name "proatlantal artery" to the suboccipital intersegmental vessel, in order to distinguish it from the hypoglossal artery above it, and all other vessels caudal to it that pass between two developing cervical segments. This vessel, passing over the atlas along with the first cervical nerve, lies above all cervical somites, hence the name.9 Although this artery and the posterior communicating artery at one stage do play a critical part in irrigating the posterior circulatory bed, it is surprising that its persistence has been reported only three times with its origin from the ICA and four times originating from the external carotid artery (Table 1).7 Only Lie7 referred to it by the correct nomenclature; the rest used descriptive terms of the vessel as it existed or functioned. Samra, et al.,12 described what actually was a proatlantal vessel as a hypoglossal artery and this designation was rightly objected to by Lie.7

The clinical significance of such primitive vessels, which originate from near the common carotid stem and supply vital hindbrain areas, has already been stressed by Flynn,8 Samra, et al.,14 and Wise and Palubinskas13 with particular reference to associated anomalies and catastrophic sequelae of their natural or surgical occlusion.

Acknowledgments

We are most grateful to Major-General A. C. Bose, AMC, Senior Consultant in Surgery, for his guidance and encouragement in preparation of this paper. We are also thankful to the Director-General, Armed Forces Medical Services, New Delhi-11, for permission to publish this report.

References