
Case Reports

A Case Report of the Left Common Carotid Artery Arising from Brachiocephalic Trunk

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During a practical anatomy course at Asahi University School of Dentistry in 2006, a case of the left common carotid artery arising directly from the brachiocephalic trunk was observed in an 80-year-old male cadaver. The origin of the left common carotid artery arising from the brachiocephalic trunk is a variant of aortic arch branching that occurs in approximately 10% of the general population^{1,2}. This variation in the origins of the aortic arch branches is discussed in relation to the developmental aspects.

Key words: Left common carotid artery, Brachiocephalic trunk, Aortic arches, Variation

INTRODUCTION

Anomalies of branches arising from the arch of the aorta are closely related to the development and involution of aortic arches of the embryonic branchial arches^{1,3,4}. The arch of the aorta has three branches: (1) the brachiocephalic trunk, which is the first and largest branch arising from the arch of the aorta, and from which the right subclavian and common carotid arteries arise; (2) the left common carotid artery, which arises immediately to the left and slightly behind the origin of the brachiocephalic trunk; and (3) the left subclavian artery, which arises directly from the posterior part of the arch of the aorta close to the left common carotid artery. These arteries are developmentally derived from the aortic arches^{1,3-5}, and abnormalities of the blood vessel system occur as a result of asymmetric development and involution of the embryonic aortic arches, which usually results in a typical pattern due to the persistence of the arches, which normally disappear, or from the disappearance of normally persisting arteries⁵. An anomaly of the left common carotid artery arising from the brachiocephalic trunk is sometimes observed and is regarded as a normal variant of aortic arch branching. Here, we report a common brachiocephalic trunk from which both common carotid arteries and the right subclavian artery arise, and discuss its developmental origins associated with aortic arches.

OBSERVATIONS

The specimen in this case was an 80-year-old male Japanese cadaver who died of liver cirrhosis and was dissected in 2006 during the student practical anatomy course of the Asahi University School of Dentistry. The arch of the aorta and its branches were photographed (Fig.1a) and recorded with line drawings (Fig.1b). The arch of the aorta passed to the left of the trachea and curved posteriorly (Fig.1a). The dotted line in Fig.1b indicates the contour of the arch of the aorta. The brachiocephalic trunk arose from the normal site of the arch of the aorta, just

crossing the trachea in front. From the proximal part of the trunk, the left common carotid artery branched off (Fig.1a, b). The brachiocephalic trunk was divided into two portions; one, the proximal portion, considerably wider than usual, the other, the distal portion, having a normal size stem (Fig.1b). It is most likely that the widening of the brachiocephalic trunk in the first portion resulted from the confluence of the left common carotid artery into the trunk. The left and right vertebral arteries arose from the normal site of each subclavian artery (Fig.1a, arrows). No other anomalies in the vascular system were observed.

DISCUSSION

There are several reports of blood vessel malformations associated with aortic arches⁶⁻¹², such as a double arch of the aorta, right arch of the aorta, retro-esophageal right subclavian artery, persistent ductus arteriosus, etc. Knowledge of the embryonic aortic arch system is required to understand the development of anomalous branches arising from the arch of the aorta. Here, we present a case of the left common carotid artery arising from the brachiocephalic trunk (usually from the arch of the aorta) and discuss its developmental aspects.

The six pairs of aortic arches are a series of vessels, that connect on each side the aortic sac with the corresponding dorsal aorta (Fig.2a). At a later developmental stage, the aortic arches are both reduced in number and extensively transformed, and finally an asymmetric blood supply system is achieved (Fig.2b, c). The 1st and 2nd aortic arches largely disappear by the time the 3rd to 6th arches develop, but the remaining parts of the 1st arch form the maxillary arteries. The 3rd aortic arch forms the stem of the internal carotid artery. The left 4th aortic arch contributes to the genesis of the arch of the aorta with the aortic sac and left dorsal aorta, and the right 4th aortic arch contributes to the proximal part of the right subclavian artery. The 5th arches atrophy altogether. At an early stage of development, from two horns of the aortic sac, the left and right common carotid arteries

develop symmetrically, but later only the right horn is involved in the genesis of the brachiocephalic trunk, known as innominate artery. On the other hand, the most proximal portion of the left horn takes part in creating the arch of the aorta with the left dorsal aortic root and the aortic sac (Fig.2a, b). Although the 3rd and 4th aortic arches symmetrically develop during an early stage of development (Fig.2b) later, because the left 4th aortic arch takes part in the genesis of the arch of the aorta, a common stem, such as brachiocephalic trunk, does not form on the left

side, and the left horn of the aortic sac usually develops apart from the future brachiocephalic trunk. An anomaly in which the left common carotid artery arises from the brachiocephalic trunk can be explained by abnormal development of the proximal part of the left 3rd aortic arch arising from the aortic sac, which is attached to the proximal common stem of the right 3rd and 4th aortic arches. The incidence of this anomaly in the general population is reported to be approximately 10%^{1,2}. Such a common brachiocephalic trunk anomaly, from which both common carotid arteries and the right subclavian artery arise, is a normal



Fig.1 a

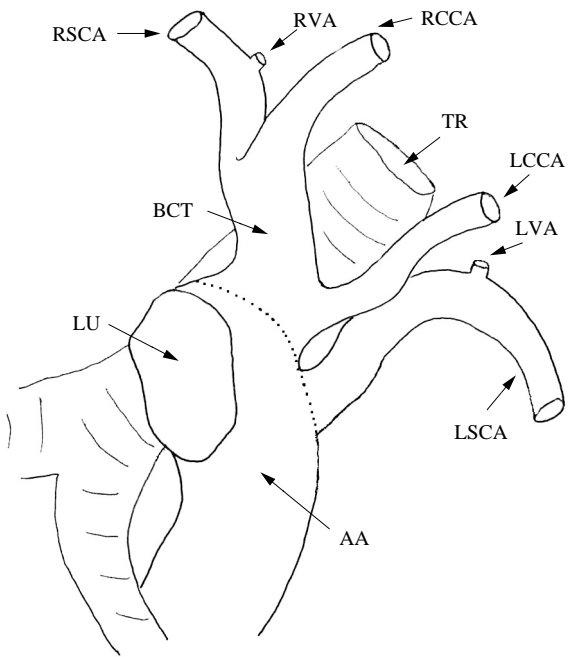


Fig.1 b

Fig.1. a. Photograph showing the arch of the aorta and its branches. Note that the left common carotid artery arises from the brachiocephalic trunk. b. Schematic representation of Fig.1 a. The dotted line indicates the contour of the arch of the aorta.

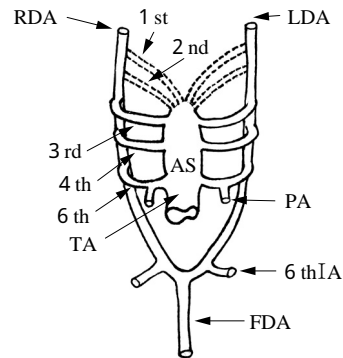


Fig.2 a

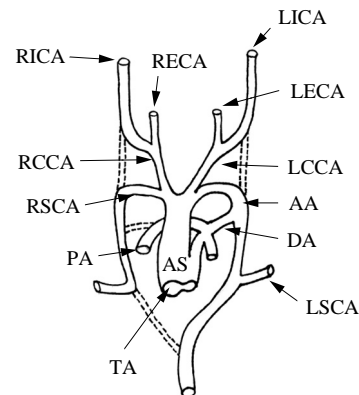


Fig.2 b

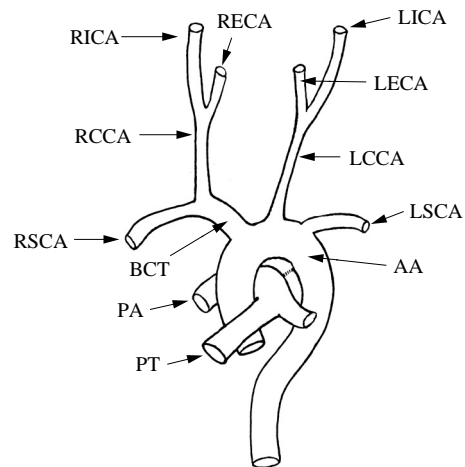


Fig.2 c

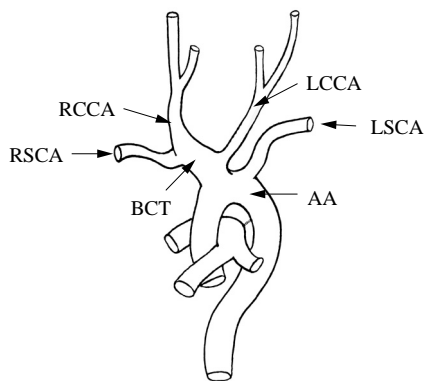


Fig.2d

Fig.2. a, b. Schematic representation of the development of the aortic arch system. The 1st and 2nd arches, indicated by dotted lines, regress as the later arches form. The proximal part of the left 3rd arch becomes the left common carotid artery and its distal portion forms the beginning of the left internal carotid artery. The brachiocephalic trunk terminates by giving origin to the proximal part of the right 3rd and 4th arches. Accordingly, the brachiocephalic trunk branches off the right common carotid artery and the stem of origin of the right subclavian artery. The external carotid arteries arise as new branches from the ventral aspects of the 3rd arches. The segments of left and right dorsal arteries connecting the 3rd and 4th arches disappear. The left 4th arch is retained as a part of the arch of the aorta, while the right 4th arch is incorporated into the proximal portion of the subclavian artery. The 5th arches are rarely recognizable, even in early development (not shown). The 6th aortic arch, called the pulmonary arch, is formed by the union of a ventral sprout from the aortic sac with a dorsal sprout from the dorsal aorta (not shown in detail). The right subclavian artery is finally formed by the right 4th arch, a part of the right dorsal artery, and the right 6th intersegmental artery. The left subclavian artery comes from only the left 6th intersegmental artery. Thus, the symmetrical development of the embryonic blood vessel system is converted into an asymmetrical arrangement by the regression of the arteries indicated by the dotted lines. (From Moor & Persaud 1993¹⁾, slightly modified)

c. A diagram of various arteries that normally develop from the aortic arches and the arch of the aorta of adult anatomy.

d. Schematic representation of the left common carotid artery arising directly from brachiocephalic trunk.

Abbreviations:

AA: arch of the aorta, AS: aortic sac, BCT: brachiocephalic trunk, DA: ductus arteriosus, ECA: external carotid artery, FDA: fused dorsal artery, LCCA: left common carotid artery, LDA: left dorsal artery, LECA: left external carotid artery, LICA: left internal carotid artery, LSCA: left subclavian artery, LU: lumen of the arch of the aorta, LVA: left vertebral artery, PA: pulmonary artery, PT: pulmonary trunk, RCCA: right common carotid artery, RDA: right dorsal artery, RECA: right external carotid artery, RICA: right internal carotid artery, RSCA: right subclavian artery, RVA: right vertebral artery, 6thIA: sixth intersegmental artery, TA: truncus arteriosus, TR: trachea

variant of aortic arch branching, and rarely poses significant problems such as occlusion or stenosis²⁾. In this case, no other structural anomalies of the cardiovascular system were observed.

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腕頭動脈に起始する左総頸動脈の一例

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2006年度朝日大学歯学部解剖実習で用いた80才男性解剖体において、左総頸動脈が直接腕頭動脈から起始する例を認めた。腕頭動脈から起こる左総頸動脈は大動脈弓の分枝の変異の一つで、その出現率は約10%である。大動脈弓の枝の由来とこの変異について、発生学的な考察を加えた。

キーワード：左総頸動脈、腕頭動脈、總弓動脈、変異