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Original Research Article

ORIGIN OF THE LEFT COMMON CAROTID ARTERY FROM THE BRACHIOCEPHALIC ARTERY

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ABSTRACT

Anatomical variations in the origin of the branches of the arch of the aorta are frequent. In this case report the left common carotid artery arose as a branch from the brachiocephalic artery. The left common carotid artery arose at a distance 11mm from the arch of the aorta and had an internal diameter of 9mm.

Key words: Aortic arch, Brachiocephalic artery, Left common carotid artery, Variation.

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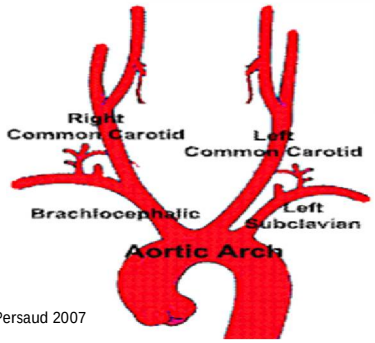
INTRODUCTION

Many variations occur in the human vascular system, not only in the peripheral vessels, but also in large vessels including the aorta. Arterial variations of the aortic arch appear in a large number of possible combinations with various frequencies [1].The arch of the aorta gives rise to three branches from the convex aspect: the brachiocephalic trunk, left common carotid and left subclavian arteries.



Moore and Persaud 2007

Variations to this normal pattern are common and described in the literature, these include branches from the beginning of the arch or the upper part of the ascending aorta; furthermore, the normal pattern of three may be reduced to two or one; the left common carotid may arise from the brachiocephalic trunk and more rarely, the left common carotid and subclavian arteries may arise from a left brachiocephalic trunk; the right common carotid and right subclavian may arise separately, in which case the latter more often branches from the left end of the arch and passes behind the oesophagus giving rise to compression symptoms and rarely the left vertebral artery may arise between the left common carotid or the subclavian arteries [2].

The arrangement of the branches of the arch of the aortic arch that are regarded as normal is encountered in 65% of cases [3].

In approximately 27% of people, the left common carotid originates from the brachiocephalic trunk thus the number of branches of the aortic arch is reduced to two as a result, both common carotid arteries arise from the brachiocephalic trunk(formerly known as the innominate artery). Both the right and left brachiocephalic trunks originate from the arch in approximately 1.2% of people. A brachiocephalic trunk fails to form in approximately 2.5% of people; in these cases each of the four arteries (right and left common carotid and subclavian arteries) originate independently from the aortic arch. The left vertebral artery originates from the arch of the aorta in approximately 5% of people. There are several other less common variations of the branches of the aortic arch e.g., instead of the normal three branches, four branches arise one of which becomes left vertebral artery which usually arises from the left subclavian artery. The above percentage statistics are according to Moore,1989 [4].

A. Two branches from the arch of the aorta (Brachiocephalic artery and Left subclavian artery).

B. Two branches from the arch of the aorta and the two branches of the brachiocephalic artery i.e. right subclavian and the right common carotid arteries).

C. The left common carotid with an internal diameter of 9.00mm.

MATERIALS AND METHODS

The Department of Anatomy in the School of Medicine at The University of Zambia currently has fifteen (15) cadavers on which third year medical students perform their dissections. Of the fifteen (15) cadavers, fourteen (14) were male and one is female. This study concerns the findings in the female cadaver.

RESULTS

During routine third year anatomy dissection of the aortic arch in the in the female cadaver of unknown age and history only two branches - the brachiocephalic artery and the left subclavian artery were found, instead of the normal three branches. The left common carotid artery arose from the brachiocephalic artery at a distance 11mm from the arch of the aorta and had an internal diameter of 9mm.

(A) (B) (C)

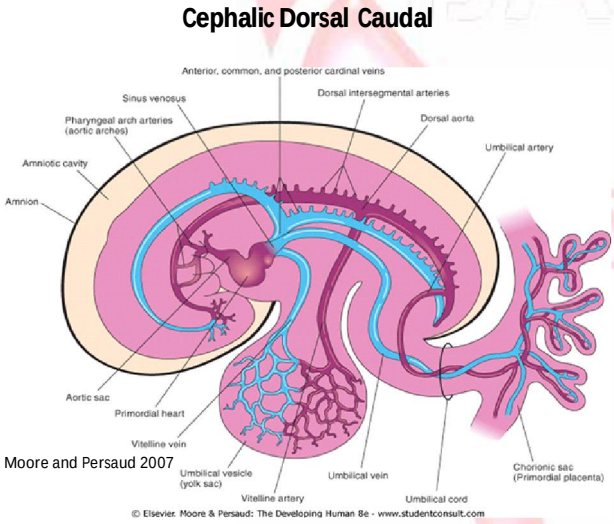
DISCUSSION

Agur and Dalley in 2013 stated thatthe normal pattern of three branches of the aortic arch has been found to be 65% and the commonest variation is the left common carotid artery originating from the brachiocephalic trunk (27%), as in this case report. Others include four arteries (left subclavian, left common carotid, brachiocephalic and vertebral arteries) originating independently from the arch of the aorta (2.5%), right and left brachiocephalic trunks originating from the arch of the aorta (1.2%) [3].

A similar pattern of variations in origin of the branches of the arch of the aorta is also recorded and published in Grays anatomy (40th edition) in which they examined 1000 aortic arches [2]. A study done by Nelson and Sparks in 2001, using 193 aortic arches found two specimens that had only two branches arising from the

aortic arch, a common trunk uniting the brachiocephalic and left common carotid arteries and a left subclavian artery.In this type, the left common carotid artery arises from a common trunk with the brachiocephalic trunk [5]. The variation observed in this case report is similar to what Sora et al. 2002, described in which the brachiocephalic artery and the left common carotid arose from a common trunk from the arch of the aorta except that in our case the left common carotid artery arose from the brachiocephalic artery [1]. In their case the left common carotid arose 10.27mm along the common trunk from the aortic arch. In our case it arose 11mm from the brachiocephalic artery.

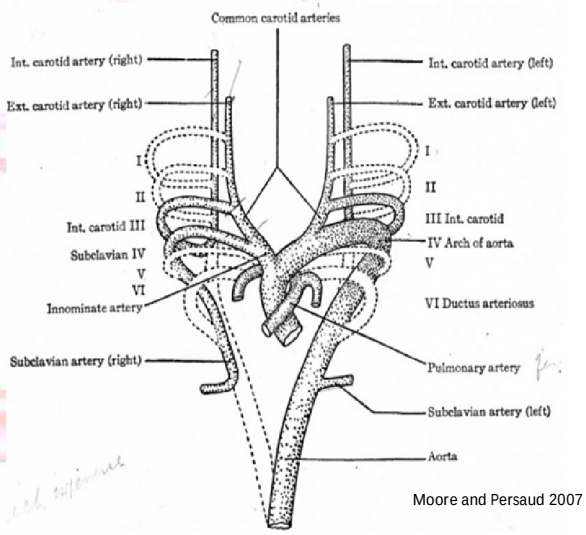
Embryologically, the aortic arches or pharyngeal arch arteries are a series of six paired vascular structures which give rise to several major arteries in the early stages of vascular development. They are ventral to the dorsal aorta and arise from the aortic sac. Some of these arteries atrophy and others persist [2].



Moore and Persaud 2007

Theaortic sac forms the right and left horns, which subsequently give rise to the brachiocephalic artery and the proximal segment of the aortic arch respectively. The proximal parts of the third pair of pharyngeal arch arteries form the common carotid arteries and the first part of the internal carotid artery while the distal parts of the third pair of the pharyngeal arch arteries join with the dorsal aortas to form the remainder of the internal carotid arteries. The fourth aortic arch on the left forms part of the arch of the aorta, between the left common carotid and the left subclavian. On the right side, it forms the proximal segment of the right subclavian artery while the distal segment of the right subclavian artery is formed by a portion of the right dorsal aorta and the seventh intersegmental artery [6,7]. As the pharyngeal arches develop during the fourth week, they are supplied by arteries-the pharyngeal arch arteries-from the aortic sac. These arteries terminate in the dorsal aorta of the ipsilateral side. Although six pairs of pharyngeal arch arteries usually develop, they are not all present at the same time. By the time the sixth pair of pharyngeal arch arteries has formed, the first two pairs have disappeared. During the eighth week, the primordial pharyngeal arch arterial pattern is transformed into the final foetal arterial arrangement [6].

Fate of pharyngeal arch arteries



Moore and Persaud 2007

The pattern described in this article results from slower growth of the ventral aortic roots between arches III–IV, allowing fusion between the brachiocephalic and left common carotid branches.The branching patterns of the aortic arch found in this study are considered normal variants and produce no observable clinical symptoms. Physicians must be aware of possible variations in these major arteries when performing procedures such as needle biopsies or injections. In surgery, misidentification of a left common carotid artery for the left subclavian artery could be life-threatening. Careful examination and correct identification of the vessels by a surgeon are essential to avoid major complications [5].

Dissection in an introductory anatomy course provides students with a unique opportunity to

appreciate how variations in anatomical structure have implications for predisposition to illness, interpretation of clinical findings including imaging studies and the planning of clinical procedures [8]. This case study contributed to the appreciation of such variations by students and emphasises the importance of carrying out dissections. Most variations are learnt theoretically in lectures but seeing them in cadavers during dissections will help students appreciate that these variations indeed occur in life.

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Conflicts of Interests: **None**

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