

# Common trunk origin of the brachiocephalic and left common carotid arteries from the aortic arch

## Abstract

Anatomical variations in the branching pattern of the aortic arch are frequent. Knowledge of these variations are important to surgeons performing thoracic surgery and interventional radiology procedures. We report a case in which the brachiocephalic and left common carotid arteries arose from a common trunk on the arch of the aorta in a female cadaver. We reviewed literature and embryonic development of this variation.

**Keywords:** aortic arch, brachiocephalic artery, left common carotid artery, cadaver, carotid arteries, brachiocephalic trunk, angiography, dyspnoea, dysphagia

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## Introduction

The arch of the aorta lies in the superior mediastinum and extends from the level of the second right sternocostal joint and ascends diagonally and to the left anterior to the trachea and descends to the left of the fourth thoracic vertebral body continuing as the descending thoracic aorta.<sup>1</sup> The arch of the aorta normally gives rise to three branches namely the brachiocephalic, left common carotid and left subclavian arteries. This is the most common pattern occurring in about 65-75% of the population.<sup>1-6</sup>

Variations in the branching pattern of the aortic arch may include; origin of the left common carotid artery from the brachiocephalic trunk, common trunk origin of the brachiocephalic and left common carotid arteries, origin of left common carotid and subclavian arteries may arise from a left brachiocephalic trunk, origin of left vertebral artery between the left common carotid and the subclavian arteries.<sup>1,2,4,7</sup> Standring<sup>1</sup> reports of rare variations such as external and internal carotid arteries arising separately, the common carotid being absent on one or both sides, or both carotids and one or both vertebral arteries may be separate branches. Embryological malformations especially of the fourth aortic arch in the first 12 weeks of foetal life results in variations in the branching pattern of the aortic arch and these abnormalities may be asymptomatic whilst some symptomatic when vascular rings surround the trachea and oesophagus causing obstruction.<sup>8</sup>

## Case report

This variation in branching pattern of the arch of the aorta was encountered during routine third year anatomy dissection in the Department of Anatomy, School of Medicine at The University of Zambia. There are a total 20 cadavers in the anatomy dissection room (16 males and 4 females). In one female cadaver of unknown age and medical history, the brachiocephalic and left common carotid arteries had a common trunk origin from the arch of the aorta (Figure 1 & Figure 2).

## Discussion

The most common variation in branching pattern of the aortic arch occurs when the branches are reduced to two<sup>1,3</sup> as in our case

report in which the brachiocephalic and left common carotid arteries arose from a common trunk on the aortic arch (Figure 1). During routine dissection in the previous academic year we came across and documented a similar variation in the branching pattern of the aortic arch except that the left common carotid artery arose from the brachiocephalic artery.<sup>9</sup> In a Kenyan population in Africa, the incidence of this variation was found to be 25.7% of the 113 aortic arches of adult cadavers.<sup>6</sup> Sora et al.<sup>10</sup> reported a similar case in which the brachiocephalic and left common carotid arteries arose from a common trunk. Rea et al.<sup>5</sup> found this variation in 22% (302/1359) patients who had undergone Multi-Detector Computed Tomography Angiography. Rekha et al.<sup>11</sup> found this variation in 2.27% of the 110 aortic arches obtained from formalin fixed cadavers in a south Indian adult population. Nelson and Sparks<sup>12</sup> found this variation in two (1.04%) out of the 193 aortic arches they examined during autopsy. Karacan et al.<sup>13</sup> found the incidence of this variation in 14.1% of the 1000 aortic arches investigated using 64-slice computed tomographic angiography and further reported that the incidences of the variations of aortic arch branching were similar among males and females (20% versus 22.1%). Natsis et al.<sup>14</sup> reported this variation in 15% (96/633) digital subtraction angiographies of Caucasian Greek patients which is a very similar incidence to what Karacan et al.<sup>13</sup> reported. The incidence of this anatomical variant has been found to vary in different studies done in different countries and also varying sample sizes may have contributed to the differences. Rea et al.<sup>5</sup> reported more aortic arch variations in males 61% (238/394) compared to females 39% (156/394). Nayak et al.<sup>15</sup> found five out of six cadavers with anomalous aortic arch branching pattern were females.

The brachiocephalic artery and the proximal segment of the aortic arch arise from the right and left horns of the aortic sac respectively.<sup>16</sup> The proximal part of the third pair of pharyngeal arch arteries gives rise to the common carotid arteries while the distal part join the dorsal aorta to form the internal carotid arteries. The left fourth pharyngeal arch artery forms part of the aortic arch. The right fourth pharyngeal arch artery forms the proximal part of the right subclavian artery whilst the distal part of the right subclavian develops from the right dorsal aorta and the seventh intersegmental artery. The left subclavian artery develops from the left seventh intersegmental artery.<sup>16,17</sup> The abnormalities and variations in branching pattern of the aortic arch are

as a result of persistence of parts of the pharyngeal arch arteries that usually disappear or also from disappearance of parts that normally persist during the transformation of the embryonic pharyngeal arch arteries into the adult arterial system.<sup>17</sup> The branching pattern reported in this case report results from slower growth of the ventral aortic roots between arches III-IV, allowing fusion between the brachiocephalic and left common carotid branches.<sup>11</sup>



**Figure 1** Common trunk origin of the brachiocephalic and left common carotid arteries.



**Figure 2** Ostium for the common trunk.

This variation in branching pattern of the aortic arch found in this study is considered a normal variant and does not produce observable clinical symptoms. Physicians must be aware of possible variations in these major arteries when performing procedures such as needle biopsies or injections.<sup>11</sup> Although anomalous origins of the aortic arch branches are merely anatomic variants, accurate information about them is vital for safe endovascular surgeries aortic instrumentation and angiographies in the thorax, head and neck region.<sup>6,10,12,13,18,19</sup> Variations in branching pattern of the aortic arch may cause dyspnoea,

dysphagia, intermittent claudication, misinterpretation of radiological examinations and complications during neck and thorax surgery and may be accompanied by other congenital abnormalities.<sup>14,18,19</sup> Students got an opportunity to appreciate some of the anatomical variations in the vascular system of the human body and also the importance of carrying out dissections.

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## Conflict of interest

Author declares that there is no conflict of interest.

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