VIA MEDICA

CASE REPORT

Folia Morphol.
Vol. 69, No. 3, pp. 184–186

ISSN 0015–5659
www.fm.viamedica.pl

Arch of aorta with bi-carotid trunk, left subclavian artery, and retroesophageal right subclavian artery

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[Received 1 April 2010; Accepted 15 June 2010]

We report a case of left sided aortic arch with three branches — a bi-carotid trunk, left subclavian, artery and right subclavian artery. The anomalous right subclavian artery presented a retroesophageal course. A right non-recurrent laryngeal nerve was noticed. The embryonic development of this branching pattern is discussed. (Folia Morphol 2010; 69, 3: 184–186)

Key words: aortic arch, retroesophageal, bi-carotid trunk, anomalous

INTRODUCTION

Variations of the great arteries in the thoracic region are well known and the aortic arch is one of them. In 65–80% of cases, three branches arise from the arch of the aorta — the brachiocephalic trunk, the left common carotid artery, and the left subclavian artery.

This pattern is described by Adachi [2] as type A. Eleven per cent of cases exhibit Adachi's type B pattern, which consists of only two trunks arising from the aortic arch — a common trunk for the left common carotid artery and brachiocephalic trunk, and the left subclavian artery. Three per cent of cases exhibit Adachi's type C pattern with four branches — brachiocephalic trunk, left common carotid artery, left vertebral artery, and left subclavian artery. Other variations in the branching pattern of the aortic arch are found in < 1% of cases [8].

We report a rare variation in the branching pattern of an aortic arch with three branches — a bicarotid trunk, left subclavian artery, and retroesophaeal right subclavian artery.

CASE REPORT

During routine dissection of the heart and great vessels, a male cadaver was noted to have an unusual branching pattern of the aortic arch. Further inspection revealed a left sided aortic arch with three branches (Fig. 1). The first branch was a bi-carotid trunk which was 1.3 cm in width and 1.2 cm in length, and divided into the right and left common carotid arteries (Fig. 2). The right common carotid passed laterally along the right side of the trachea with a normal distribution. The left common carotid passed along the left side of the trachea with a normal course and distribution. The second branch was the left subclavian artery with a diameter of 0.8 cm following normal course and distribution.

The third branch was the right subclavian artery, which was 1.2 cm in diameter, arising more posteriorly about 1.4 cm distal to the origin of the left subclavian artery (Fig. 3). It crossed the oesophagus and trachea in a posterior position to reach the right upper limb. A right non-recurrent laryngeal nerve was observed arising from the right vagus at the upper

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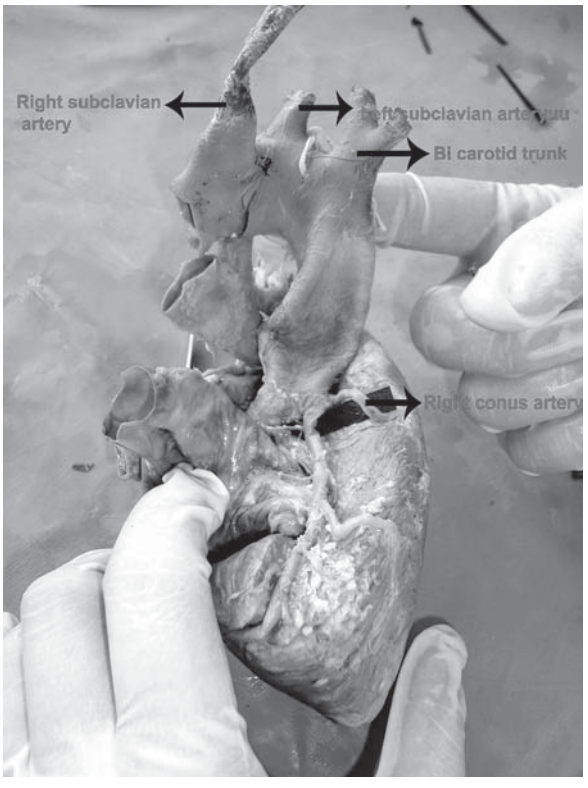

Figure 1. Arch of aorta with three branches.

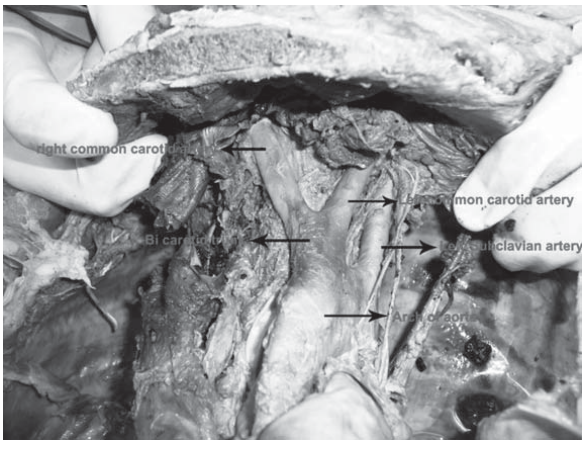

Figure 2. Arch of aorta with bicarotid trunk and left subclavian artery

pole of the thyroid gland, which entered the larynx. Left recurrent laryngeal looped normally around the aortic arch. No other variations were observed in the branching pattern and distribution of the other great vessels.

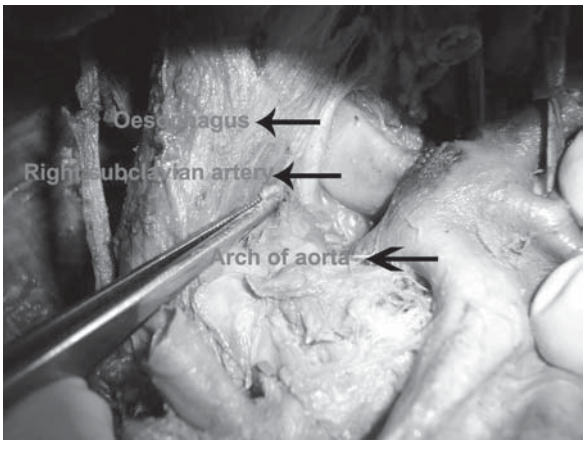

Figure 3. Right subclavian artery arising from posterior aspect of arch of aorta.

DISCUSSION

The variations in the branching pattern of the aortic arch are a result of altered development of primitive aortic arches. Momma et al. [9] noted that aortic arch anomalies are associated with chromosome 22q11 deletion.

Liechty et al. [7] reported the same variation in 10.7% of cases based on a study of 1000 cadavers. Mligiliche et al. [10] reported this variation in a case study. Mc Donald and Anson [8] reported anomalous right subclavian artery with retroesophageal course in 2.5% cases. Holzapfel [6] studied 133 autopsy cases of right subclavian artery as a last branch. He reported that in 80% of cases it passed behind the oesophagus, in 15% of cases between the trachea and oesophagus, and in 5% of cases in front of the trachea. Poultsides et al. [12] and Naik et al. [11] described the embryological basis of anomalies of common carotid arteries.

A third pair of aortic arches arising from the aortic sac give rise to right and left common carotid arteries. The aortic sac bifurcates into right and left horns. The arch of aorta is developed from the aortic sac, its left horn, left fourth aortic arch, and part of the left dorsal aorta. The brachiocephalic trunk develops from the right horn of the aortic sac. The right subclavian artery develops from the right fourth aortic arch, part of the right dorsal aorta, and the right seventh intersegmental artery. The common carotid artery develops from the third aortic arch proximal to the external carotid branch.

EMBRYOLOGICAL BASIS OF VARIATION IN THIS CASE

If the aortic sac fails to bifurcate, then the left common carotid artery will connect to the aortic sac directly, resulting in a bicarotid trunk [11, 12].

An anomalous right subclavian artery is due to early involution of the right fourth aortic arch and the cranial part of the right dorsal aorta. Subsequently, the artery develops from the right seventh cervical intersegmental artery and the right dorsal aorta caudal to it. A regression of the right fourth aortic arch would result in the right recurrent laryngeal nerve coming directly from the cervical part of the vagus nerve without taking a recurrent course to reach the cricothyroid membrane.

The branching pattern of the aortic arch described in this case report is generally considered asymptomatic. However, the anomalous right subclavian artery may become tortuous and ectatic resulting in oesophageal or tracheal compression causing dysphagia lusoria [1, 3, 4]. Anomalous arteries may be associated with aneurysms. An anomalous origin and distribution of the large aortic vessels can cause changes in cerebral haemodynamics that may lead to cerebral abnormalities [5]. The retroesophageal right subclavian artery is also important to an angiographer who uses the right axillary, brachial, or radial approach to the ascending aorta. The right non-recurrent laryngeal nerve is an asymptomatic variation which can be damaged during cervicotomy and thyroid and parathyroid surgeries.

CONCLUSIONS

Awareness of vascular variations is imperative in diagnostic procedures and in planning surgical interventions.

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