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Aortic Arch variations –A rare finding

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Abstract *: Variations of the branches of aortic arch are due to alteration in the development of certain branchial arch arteries during embryonic period. Knowledge of these variations is important during aortic instrumentation, thoracic, and neck surgeries. In the present study we observed these variations in 42 cadavers from North coastal Andhra Pradesh . In 40 cadavers, the aortic arch showed classical branching pattern which includes brachiocephalic trunk, left common carotid artery, and left Subclavian artery. But one cadaver showed Brachiocephalic trunk and Left subclavian artery are the only branches . Left common carotid is seen as a branch of brachiocephalic trunk. The aim of this study was to determine the anatomical basis needed for its surgical procedures. The branching pattern of the aortic arch was studied; diameters of its branches and the distance from their origin to the mid-vertebrae line were measured. In all of the cases, the brachiocephalic trunk, left common carotid and left subclavian artery originated independently. One of the variants had two branches, the left subclavian artery and a common trunk which incorporated the brachiocephalic trunk and left common carotid. There was a significant correlation between the diameters of brachiocephalic trunk and left subclavian artery. A significant strong positive correlation between the distances from the origins of left common carotid and left subclavian artery from the mid vertebrae line was found. The results in this study provide accurate information considered vital for vascular surgery.*

Keywords: *Variation, Aortic arch, Mid-vertebrae line.*

I. Introduction

Aortic arch (AA) is located in the superior mediastinum. In 65–80% of the cases the three branches arise from aortic arch, namely, the brachiocephalic trunk (BCT), the left common carotid artery (LCCA), and the left subclavian artery (LSA). The point of origin of BCT trunk lies to the right of midvertebral line and that of LCCA and LSA to the left of midvertebral line. Variations in the branching pattern of the AA range from differences in the distance between origins of different branches to the number of branches [1, 2]. The anatomical variations in the branching pattern of AA are significant for diagnostic and surgical procedures in the thorax and neck. The present study describes the AA branching pattern in cadavers from North coastal Andhra Pradesh.

II. Material And Method

The study was conducted on Forty-two cadavers at the Department of Anatomy as per the dissection schedule for MBBS students, . The thoracic cavity was opened by cutting through the costochondral junctions and removing the sternum and costal cartilages. The lungs were removed, superior vena cava and brachiocephalic veins cleared, and pericardium opened to expose ascending aorta. Fibro fatty tissue and nerves were removed to clarify the branches of aortic arch and variations in branching pattern observed.

III. Case Report

In all the cadavers the AA showed classical branching pattern of BCT, LCCA, and LSA (Figure1). One of them showed variation in the branching pattern : had two branches, namely, LSA and a common trunk (CT) that gave origin to BCT and LCCA (Figure 4). The Brachiocephalic vein seen passing infront of AA(Fig 1). The point of origin of BCT lies to the right of mid vertebral line in 41 cases, but in this case the point of origin of LCCA is on the left of vertebra as it is arising from BCT. (Figure 5); here BCT crossed obliquely upward in front of trachea to reach from left to right side. The left subclavian artery is found lying posteriorly.(Fig.3)

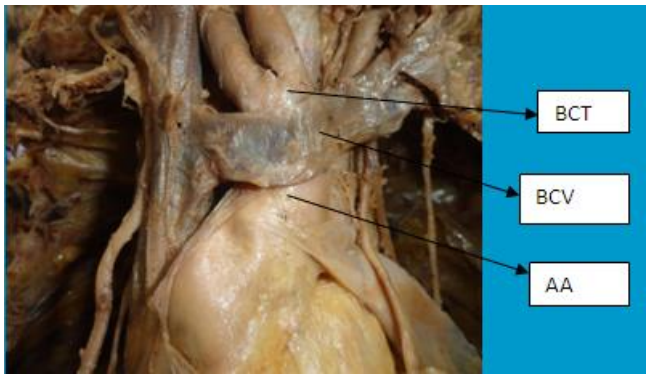

Figure 1: Aortic arch crossed by Brachiocephalic vein. BCT: brachiocephalic

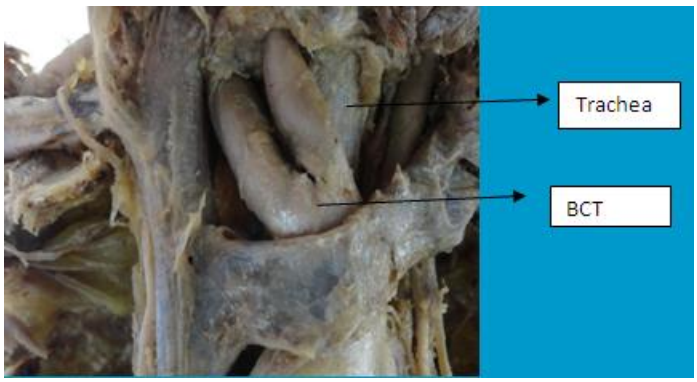

Figure 2: Aortic arch Showing BCT lying right side of the trachea. (Vertebra)

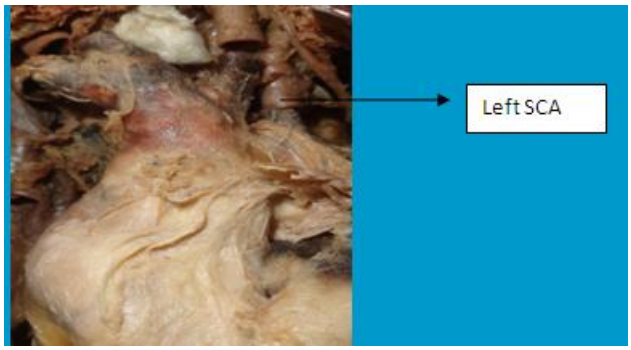

Figure 3: Aortic arch showing BCT with 3 branches. Left SCA lying posterior to normal origin

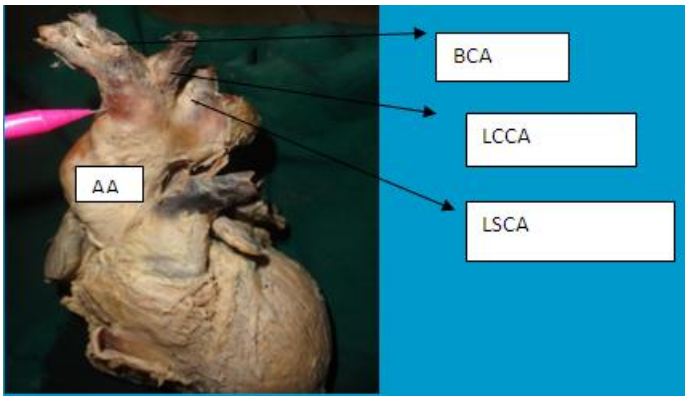

Figure 4: Aortic arch showing three branches (common trunk for brachiocephalic trunk and left common carotid artery). CT: common trunk, BCT: brachiocephalic trunk, LCCA: left common carotid artery, LSA: left subclavian artery.

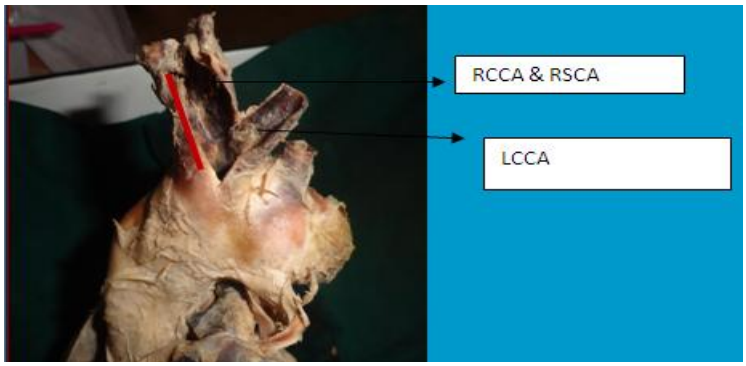

Figure 5: Point of origin of left common carotid as originating from BCT. BCT Is of about 2cms in length. Appreciate the lumen also.

IV. Discussion

The AA usually gives three branches, namely, the BCT, LCCA, and LSA. In the present study the usual three-branch pattern was observed only in all cases; however in one of the case the aortic arch showed variations from usual branching pattern .

(Table 1)

S.No	Normal 3 BRANCHES	Abnomal	Vertebrate deviation Rt or lt
1	N	--	BCT Rt LCCA & SCA lt
2	N	--	BCT Rt LCCA & SCA lt
3	N	--	BCT Rt LCCA & SCA lt
4	N	--	BCT Rt LCCA & SCA lt
5	N	--	BCT Rt LCCA & SCA lt
6	N	--	BCT Rt LCCA & SCA lt
7	N	--	BCT Rt LCCA & SCA lt
8	N	--	BCT Rt LCCA & SCA lt
9	N	--	BCT Rt LCCA & SCA lt
10	N	--	BCT Rt LCCA & SCA lt
11	N	--	BCT Rt LCCA & SCA lt
12	N	--	BCT Rt LCCA & SCA lt
13	N	--	BCT Rt LCCA & SCA lt
14	N	--	BCT Rt LCCA & SCA lt
15	N	--	BCT Rt LCCA & SCA lt
16	N	--	BCT Rt LCCA & SCA lt
17	N	--	BCT Rt LCCA & SCA lt
18	N	--	BCT Rt LCCA & SCA lt
19	N	--	BCT Rt LCCA & SCA lt
20	N	--	BCT Rt LCCA & SCA lt
21	N	--	BCT Rt LCCA & SCA lt
22	N	--	BCT Rt LCCA & SCA lt
23	N	--	BCT Rt LCCA & SCA lt
24	N	--	BCT Rt LCCA & SCA lt
25	N	--	BCT Rt LCCA & SCA lt
26	N	--	BCT Rt LCCA & SCA lt
27	N	--	BCT Rt LCCA & SCA lt
28	N	--	BCT Rt LCCA & SCA lt
29	N	--	BCT Rt LCCA & SCA lt
30	N	--	BCT Rt LCCA & SCA lt
31	N	--	BCT Rt LCCA & SCA lt
32	N	--	BCT Rt LCCA & SCA lt
33	N	--	BCT Rt LCCA & SCA lt
34	N	--	BCT Rt LCCA & SCA lt
35	N	--	BCT Rt LCCA & SCA lt
36	N	--	BCT Rt LCCA & SCA lt
37	N	--	BCT Rt LCCA & SCA lt
38	N	--	BCT Rt LCCA & SCA lt
39	N	--	BCT Rt LCCA & SCA lt
40	-	Showed only 2	BCT on Rt LSCA Post

41	N	--	BCT Rt LCCA & SCA lt
42	N	--	BCT Rt LCCA & SCA lt

The most common variant branching pattern which we observed in our study was the two-branch pattern. The two branches were the LSA and CT giving origin to BCT and LCCA. CT giving origin to BCT and LCCA which was previously reported by a number of authors in their case reports [15–17]. The results of the previous studies describing two-branch pattern in different population group varied from 1% to 28%.

Developmentally the two-branch pattern of the AA may be explained as follows. Aortic sac normally bifurcates into left and right limbs. Left limb of aortic sac forms the part of arch that intervenes between the origin of BCT and LCCA. If the aortic sac fails to bifurcate, then the LCCA will connect to aortic sac directly, resulting in bicarotid trunk or common trunk giving origin to BCT and LCCA as observed in our study [18, 19]. The approximation of LCCA to BCT is an important observation while invading the AA and its branches with instrument as all cases are susceptible to surgical attack [14, 20]. Non recognition of a critical AA at surgery may cause fatal consequences [5]. Sometimes such AA anomalies are clinically useful, as catheterization of LCCA originating from BCT or CT can be achieved without catheter exchange [9].This AA

Branching pattern and its relation to the tracheais important during surgeries of throat and even more important in percutaneous dilatational tracheostomy, which has gained wide acceptance due to relative speed, simplicity, and ability to perform it on bedside as these variant anatomy may block the site for tracheostomy [20]. Knowledge of such variations of great vessels is of vital interest to the surgeons because a minor accidental injury of the vessels causes sudden massive hemorrhage [21].

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