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Research Article

A STUDY OF AORTIC ARCH IN HUMAN FETUSES OF NORTH COASTAL ANDHRA PRADESH

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ABSTRACT

In paediatric cardio vascular surgery, knowledge of various arrangements of aortic arch and its branches is essential. The present study is taken up to describes the aortic arch branching pattern in human fetuses, as the study material can be available easily & literature regarding the fetuses is very limited**.** The aim of the present study is to determine the incidence of various aortic arch anomalies in human fetuses of North coastal Andhra Pradesh. The study was conducted in 150 still born fetuses, collected from the college hospital and local nursing homes. The study was carried out by conventional dissection method. The results were not related with age & gender of the fetuses.The normal branching pattern was observed in 110 fetuses (73.3%). The 3 types of variant branching pattern was observed with an incidence of 26.6%. In 30 fetuses the branches were reduced to 2, common trunk (brachiocephalic trunk & left common carotid artery) and left subclavian artery. The left vertebral artery originated directly from aortic arch in between left common carotid and left subclavian arteries in 6 fetuses. In 4 fetuses the branches were common trunk, left vertebral artery & left subclavian artery. Congenital abnormalities of aortic arch result from aberrant development of 1 or more components of embryonic pharyngeal arch system and represent less than 1% of all congenital cardiac defects. Variations of aortic arch appear in a large number of possible combinations with various frequencies. Most of the variations are asymptomatic and may be uncovered as a sudden finding in imaging studies.

Key Words: *Foetus, Aortic Arch, Variation*

INTRODUCTION

The aortic arch is a continuation of ascending aorta, being located in the superior mediastinum. 3 branches brachio cephalic trunk (BCT), the left common carotid artery (LCC) & left subclavian artery (LSA) spring from the convexity of aortic arch. The number of primary branches may be reduced to 1-2 or increased to 4-6 (Adachi 1928, Anson 1971, Roguin 1982, Testut 1948). Aortic arch anomalies are associated with chromosome 22q11 del (Momma et al 1999). The definitive aortic arch is developed from 3 sources from ventral to dorsal are 1) left limb of aortic sac 2) left 4^{th} aortic arch & 3) left dorsal aorta.. Left limb of aortic arch forms part of aortic arch which intervenes between origins of BCT& LCC. The left 4^{th} aortic arch forms that part of the arch which extends between LCC& LSA. Left dorsal aorta forms the distal part of arch of aorta.

Developmental anomalies in aortic arch pattern arise from unusual patterns of development of embryonic arterial arch system, such that there may be persistence of aortic arch that normally disappear or disappearance of the parts that normally persist. The common sharing of BCT & LCC may be a marker for the presence of accompanying congenital cardiac defects & coronary arterial abnormalities (Moskowitz 2003). Bernardi *et al.,* (1975) hypothesized that anomalous origins and the distribution of the large aortic arch vessels could cause changes in cerebral haemodynamics that might lead to cerebro vascular catastrophies.

MATERIALS AND METHODS

150 still born fetuses aged ranging from 10 wks to full term, collected from the college hospital & local private nursing homes constitute the material for the present study. The fetuses were injected with 10% formalin & then allowed for fixation by keeping in 10% formalin for 48 hours.

The age of the fetuses was assessed by measuring the crown rump length and examined thoroughly for any external malformations. The study was conducted by conventional dissection method& the thorax was exposed to study the arch of aorta after careful reflection of the thymus and brachio cephalic veins.

RESULTS

In all the fetuses the ascending aorta ascends upwards for a short distance, arched backwards over the root of the left lung and then descends along the left side of vertebral column i.e., the left sided aortic arch was noted. In 110 fetuses (73.3%), the normal branching pattern with 3 branches arising from ventral to dorsal are BCT, LCC & LSA (Fig 1) was noted. The number of branches was reduced to 2, they were 1) Common trunk (CT) i.e., common sharing of brachiocephalic trunk with LCC & 2) LSA, which was observed in 30 foetuses (20%) (Fig 2). The branches increased to 4 in 6 fetuses (4%), BCT, LCC, LVA& LSA were the branches from right to left (Fig 3). In 4 fetuses, even though the branches were 3, the branching pattern was not normal as the branches were CT, LVA & LSA (Fig 4).

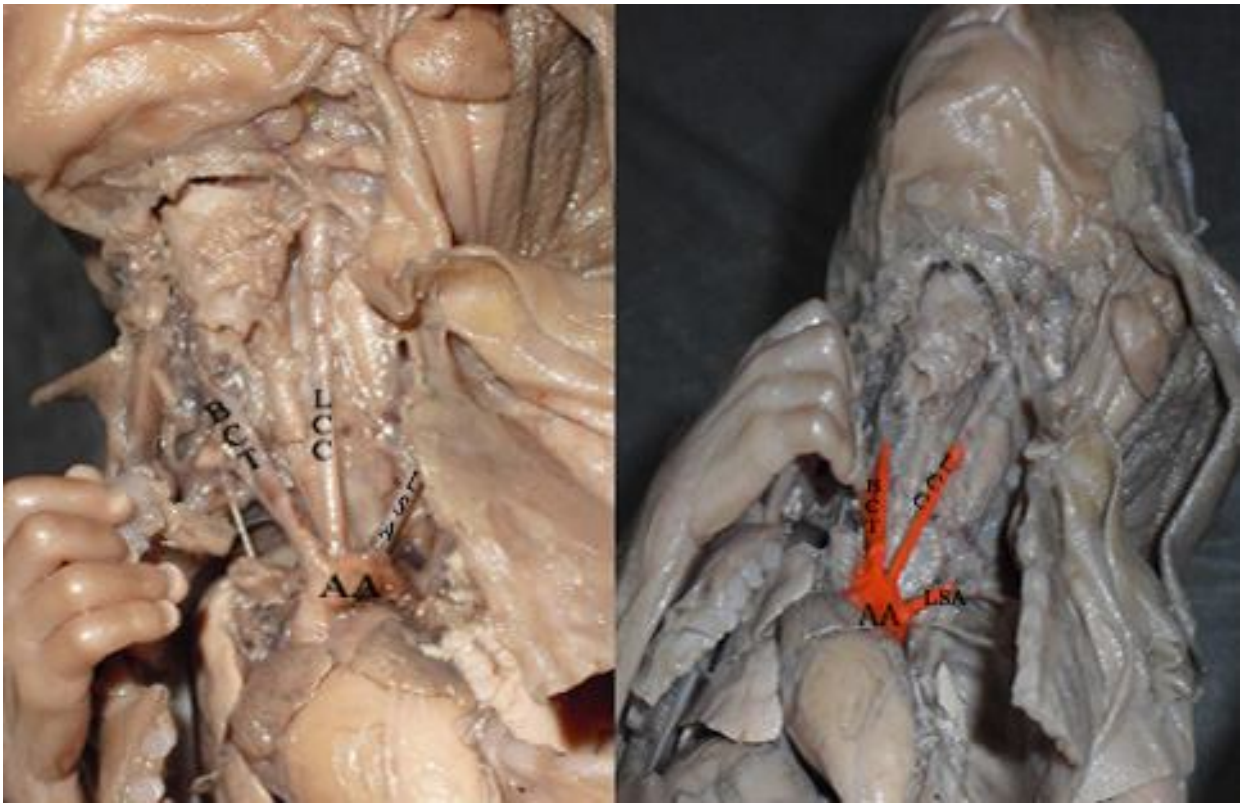

Figure 1: Typical branching pattern in 20 weeks G.A. foetus

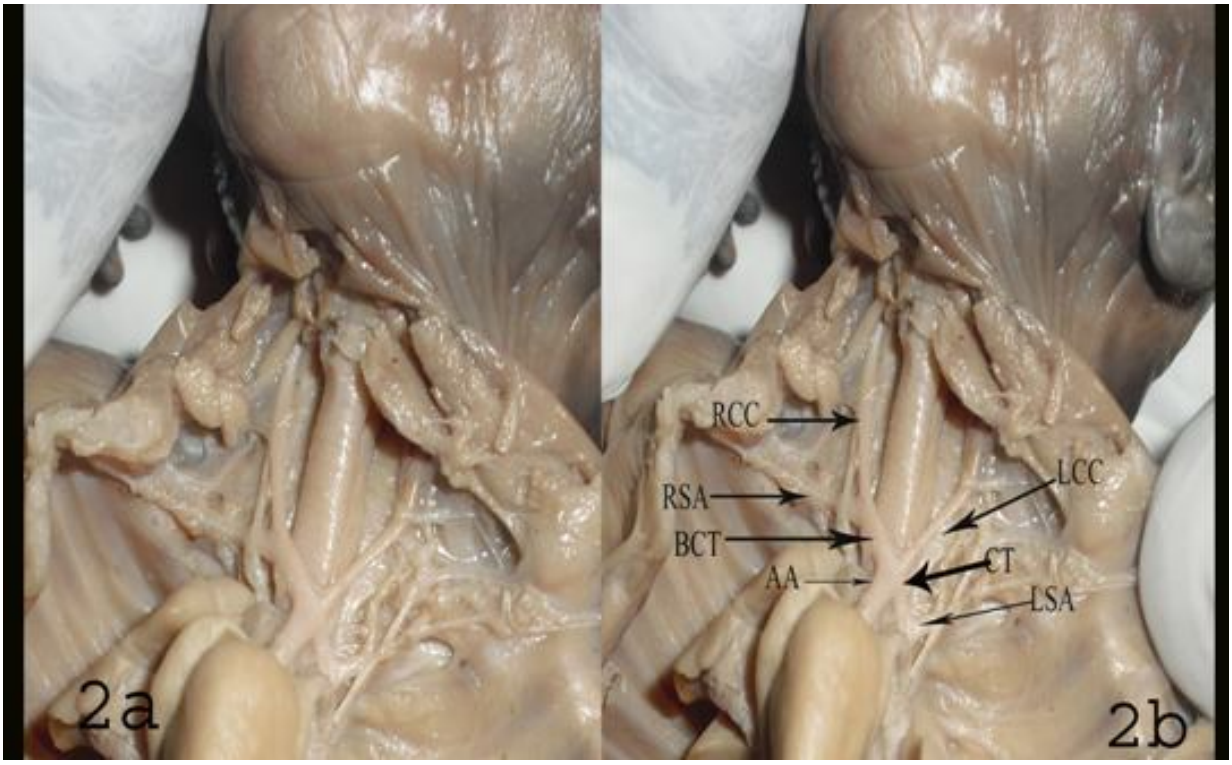

Figure 2a & 2b: Common sharing of BCT & LCC.

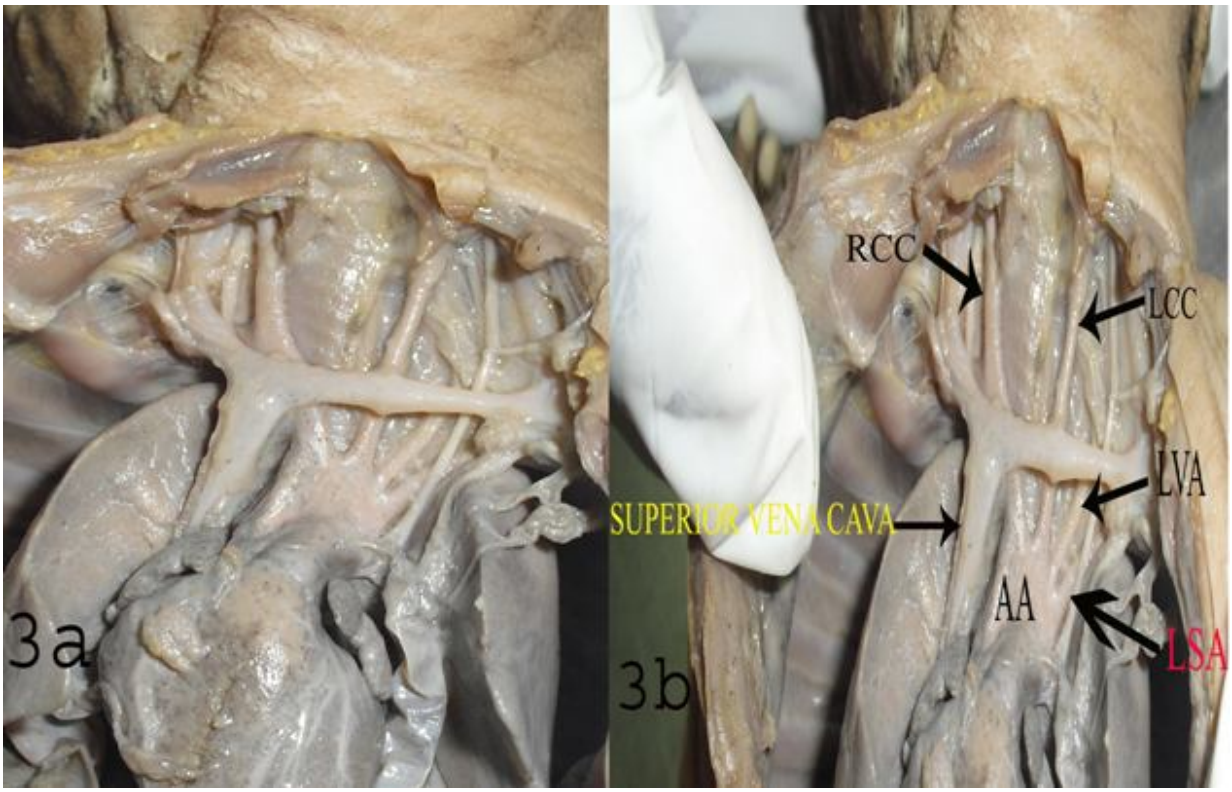

Figure 3a & 3b: Origin of LVA directly from aortic arch.

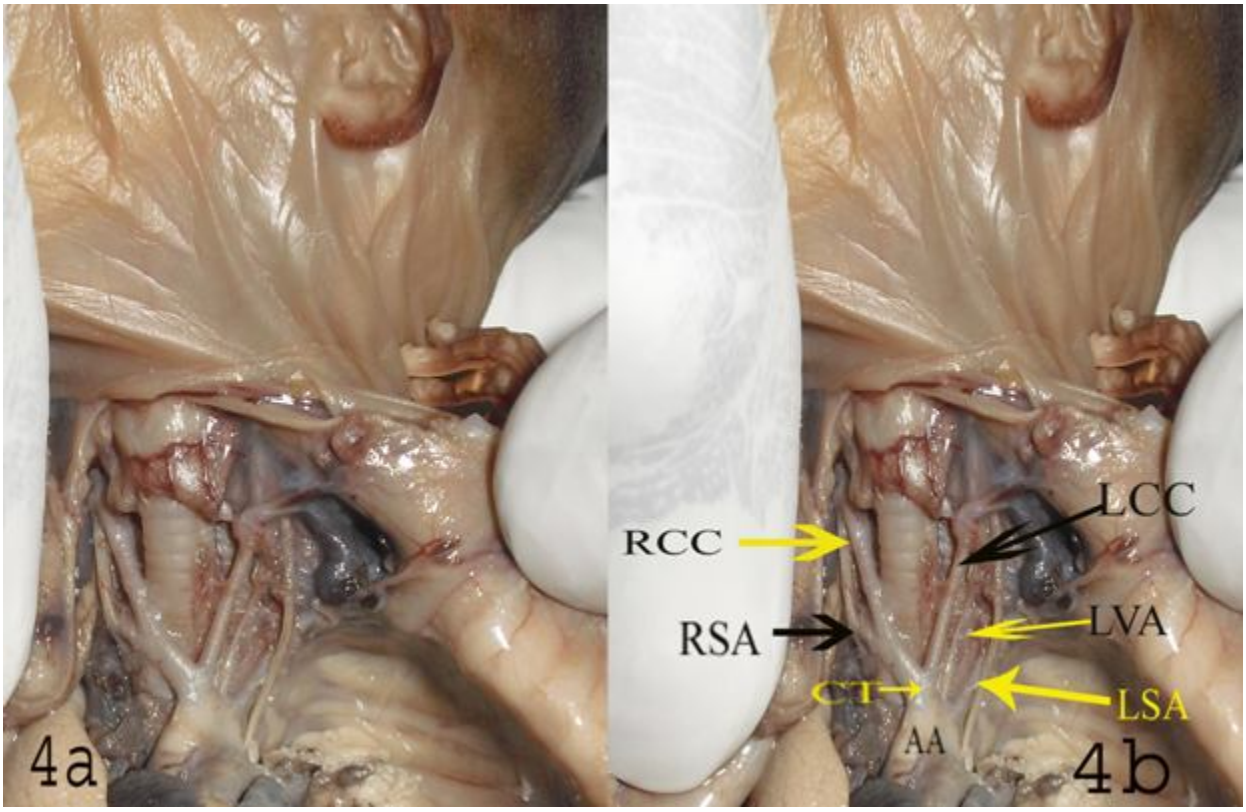

Figure 4a and 4b: Common sharing of BCT & LCC and origin of LVA directly from aortic arch

DISCUSSION

The proximal part of the third aortic arch normally gets extended and absorbed into the left horn of aortic sac. If it gets absorbed into the right horn of the aortic sac, it can lead to anomalies where the left common carotid artery arises from the brachiocephalic trunk i.e., common sharing of BCT&LCC, which was noted in 34 fetuses out of 150. Out of these 34, 4 fetuses shows an additional branch, LVA in between CT & LSA. Origin of LVA directly from aortic arch suggests that part of aortic arch arises from the left 7th intersegmental artery or there was increased absorption of embryonic tissue of the left subclavian artery between origin of aortic arch and the left vertebral artery (Moore 2003). Albayaram *et al.,* (2002) suggested that the aberrant origin of LVA directly from aortic arch is due to the persistence of 8th intersegmental artery. In the present study LVA originated directly from aortic arch in 10 fetuses out of 150 (6.66%). Anson studied aortic arch in 1000 adult cadavers , identified various aortic arch patterns & regarded as "normal" for human (Type I) is encountered more frequently (64.9%). In 27.1% of cases, Anson (1971) found common origin of BCT & LCC arteries (Type II). In Type III of Anson (1971), origin of LVA from aortic arch was noted in 3.8% of cases. Anson (1971) identified bicarotid trunk (0.9%), bi-innominate trunk (1.2%) & all the main branches from a single trunk (0.3%). Michal Szpinda *et al.,* (2005) worked on 131 human fetuses & identified normal branching pattern in 70.05%, common trunk in 20.61% & direct origin of LVA from aortic arch in5.34% of cases. Shin *et al.,* (2008) found LVA from aortic arch in5.8% of cases, where as Lemke *et al.,* (1999) observed that LVA may have duplicate origin from the arch and the subclavian artery. Best & Bumpers (2002) reported a case in which the right vertebral artery originated directly from the aortic arch.

A study by Nayak *et al.,* (2006) reported the classical branching pattern of aortic arch in 91.4%, and the LVA arising from AA in 1.6% of the cases. Bergman *et al.,* (2009) reported a case of the RVA directly

arising from the aortic arch, and the frequency of the BCT providing origin to the LCCA was 11%, with the LSA arising independently from the arch. Non-recognition of a critical aortic arch branch variation at surgery may cause fatal consequences (Satyapal 2003).

The results of the present study were nearly similar to that of various workers like Michal Szpinda (2005), but one remarkable finding in the present study, the variant 3 branching pattern 1) the common trunk, 2) LVA & 3) LSA was noted in 4 fetuses out of 150 cases, which was not described in the literature.

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