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Abnormal Origin and Course of Left Vertebral Artery

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1. INTRODUCTION

Arterial derangements within the thorax are common. These variations can assume different forms. Among these variations in the branching pattern of arch of aorta is most common. These derangements in origin and course of main vessels can occur as an isolated variations or occurring in combination with other cardiovascular defects. Most of these variations resulting in clinically relevant anomalies are explainable onto genic basis (1.Rajan kumar SINGLA et al., 2010). Understanding the great vessels originating from aortic arch and their variations is important both for endovascular interventionist and diagnostic radiologist. This is more important in vascular surgeries involving placement of carotid artery stents, vertebral artery stents and also facilitates intercranial intervention procedures (2. S.R. Satti et al., 2007). Thorough knowledge of anatomy can avoid many complications during neck and thorax surgeries.

Adachi first classified the branching pattern of arch of aorta (C Bhattarai et al., 2010),

Type A – Three branches arise from arch of aorta, i.e., from medial to lateral brachiocephalic trunk , left common carotid , left subclavian arteries (80%).

Type B – Two branches arising from arch of aorta due to a common trunk incorporating left common carotid artery and brachiocephalic trunk (11%).

Type C – Having four branches with the origin of left vertebral artery, a fourth branch of arch of aorta arising medial to left subclavian artery.

Numerous other variations of the branching pattern of arch of aorta are found in less than 1% of cases (Bergmann et.al. 2000).

2. MATERIALS AND METHODS

During routine undergraduate dissections at Sri Venkateswara Medical College, Tirupathi, over a period of 2 years on 12 cadavers, variation in the origin and course of left vertebral artery was found in 2 cadavers. Out of 2 cadavers, one is male and other is female cadaver.

3. RESULTS

The usual three branched aortic arch was found in about 83.3%.Two types of variations are observed. . In male cadaver, left vertebral artery originated from arch of aorta at the upper angle of the junction of the left subclavian artery (Fig.1), passed through the thorax and neck and entered 5thforamen transversarium of cervical vertebra with incidence of 8.3%. Other variations observed in male cadaver are absence of horizontal fissure of right lung, variations in formation and branching of brachial plexus, levator glandule thyroidea. In female cadaver, left vertebral artery arose from the upper convexity of arch of aorta between left common carotid and left subclavian arteries, entered the 5th foramen transversarium of cervical vertebra with incidence of 8.3%(Fig.2).Other variations observed in female cadaver are variations in the division of left femoral artery, variation in the branching pattern of right femoral artery, variations of peroneus tertius and extensor digitorum longus of right and left sides. There were no noticeable differences in the heart.

4. DISCUSSION

Variations in the branching pattern of arch of aorta are likely to occur as a result of the altered development of certain brachial arch arteries during embryonic period of gestation(C Bhattarai et al., 2010). The true value of detecting anomalous origins is the diagnostic gain prior to the surgery of supra aortic arteries. Non- recognisation of critical aortic arch branch variation at surgery may cause fatal consequences (Soubhagya R. Nayak et al., 2006). Anomalous origins may lead to altered hemodynamics and predispose the patient to intracranial aneurysm formation (Aprajita Sikka et al., 2012). In thyroid surgery, variant left vertebral artery might be mistaken for inferior thyroid artery and its ligation during surgery leads to altered cerebral hemodynamics. Arteria thyroidae ima, direct branch from arch of aorta if not ligated in thyroid surgery leads to severe haemorrhage. In addition, knowledge of abnormal branches originating from the aortic arch is also important in the diagnosis of intracranial aneurysms following subarachnoid haemorrhage (Mange Manyama et al., 2011).

5. EMBRYOLOGY

The embryo develops 6 sets of matched aortic arches. These arches undergo selective apoptosis, and the residual branch vessels constitute the aortic arch and great vessels. During this process, anatomic variants can form. Small intersegmental branches of the dorsal aorta extend from the cervical to the sacral region to vascularise the developing somites (S.R. Satti et al., 2007) .Vertebral artery is an important vessel, which arises as a secondary development, on each side of the midplane, from a series of dorsal rami of dorsal intersegmental arteries belonging to the neck.These rami undergo longitudinal linkage just dorsal to the ribs (post costal anastomosis). All of the original stalks then atrophy except the most caudal one in the series.The resulting longitudinal vessel is the vertebral artery; it takes origin along with the subclavian from the seventh intersegmental artery (Aprajita Sikka et al., 2012). In cases, where vertebral artery arises from aortic arch, we feel,that dorsal branch of 6th intersegmental artery (segment b'c'), 6th intersegmental artery itself (segment a'b') and segment aa' of dorsal aorta fail to disappear, so blood flows through these persist segments forming a vertebral artery of aortic arch origin. As a preferential blood flow to this persistent channel (a-a'-b'-c'), the blood flow through channel (b-c-d) decreases which ultimately disappears (Rajan Kumar SINGLA et al., 2010). Origin of vertebral arteries from the aorta suggest that part of aortic arch arises from the left 7th inter-segmental arteries or there was increased absorption of embryonic tissue of the left subclavian artery between origin of aortic arch and the vertebral artery (Mange Manyama et al., 2011). These two scenarios could explain the findings in the cases described in this study.

6. CONCLUSION

As the arterial variations are common, prior angiography benefits the patient, resqueing from the hazards of surgical complications like non-ligation and ligation of vessels, altered cerebral hemodynamics and one vessel may be mistaken for another vessel. Altered hemodynamics may predispose to intracranial aneurysm formation. Endovascular therapy can be performed in these patients before they present clinically with subarachnoid hemorrhage. As prevention is better than cure, diagnosing and treating the patient before hand is better than treating the complications.

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