Anomalous Origin of Left Vertebral Artery — Embryological Basis and Applied Aspects – A Case Report

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Abstract. The study reports the anomalous origin of left vertebral artery along with variations in the branching pattern of subclavian artery. Left vertebral artery originated from the aortic arch while the right from the subclavian artery. Though thyrocervical branches of subclavian artery were present, its inferior thyroid branch was absent on both the sides. The diameter of the prevertebral segment (first part) of left vertebral artery was less than that of right vertebral artery.

Key words: Vertebral artery; variations, subclavian artery, inferior thyroid artery.

Introduction:

The course and variability in origin of left vertebral artery (Nizanowski, et al, 1982) and its importance in cerebral disorders clinically (Vicko et al, 1979) and surgically (Bernardi and Deton, 1975) has been described. Its importance in head and neck surgery, angiography and arterial dissection (Komiyana et al, 2001) has also been mentioned in the literature.

The vertebral arteries arise from the superoposterior aspect of the first part of subclavian artery. The vessel takes a vertical posterior course to enter into the foramen transversarium of sixth cervical vertebra. The segment of the artery from its origin at subclavian artery to its respective transverse foramen is called the pretransverse or prevertebral segment (Matula et al, 1997).

In our study the left vertebral artery originated directly from the arch of aorta, in addition to that the inferior thyroid branch of throcervical trunk was absent on both sides.

Materials and Methods:

An unusual origin of prevertebral segment of left vertebral artery from arch of aorta and bilateral absence of inferior thyroid artery was seen during routine dissection in a middle aged female cadaver.

The length of both vertebral arteries was measured from the point of origin to their entrance in foramina transversaria of C6. Also diameters were determined at their origin with the aid of sliding calipers.

Observations:

Right vertebral artery originated from the superior aspect of the first part of subclavian artery and traversed medially anterior to scalenus anterior and longus colli behind the common carotid artery and was related posteriorly to the stellate ganglion and ventral rami of seventh and eight cervical spinal nerves before entering the foramen transversarium of C6 vertebra. (Fig 1).

Left vertebral artery, originated directly from arch of aorta between the left common carotid artery and left subclavian artery. The artery, ascended behind the left common carotid artery while stellate ganglion and ventral rami of cervical spinal nerves were related posteriorly and thoracic duct arched anterior to it before it entered the foramen transversarium of C6 vertebra. (Fig 2).

The left vertebral artery varied in its origin and topography. It was narrower and longer as compared to the right vertebral artery. The diameter of left vertebral artery at origin was 3.1 mm as compared to that of the right, which had a diameter of 6.5 mm at origin. The length of right vertebral artery was 3.8 cm and that of left vertebral was 9.2 cm.

Additional abnormality of absence of inferior thyroid branch of thyrocervical trunk was noticed on both sides. The arterial supply of thyroid gland was completely via superior thyroid artery coming from external carotid artery, which reached up to the inferior pole of the thyroid gland.

Discussion:

Anatomic and morphological variations of the vertebral artery are of immense importance in surgery, angiography and all non-invasive procedures. (Matula et al 1997).

In our study we found the abnormal origin of left vertebral artery in 1 out of 20 cadavers (5%) dissected during 1998-2002. Literature shows the frequency of origin of the left vertebral artery from aortic arch in the range of about 1%-3% (Dasler and
Anson, 1959).

According to Bernardi and Deton (1975), the abnormal origin of vertebral artery “may favour cerebral disorders because of alterations in cerebral hemodynamics.” The prevertebral segment of vertebral artery is frequently affected with atherosclerosis. (Vicko et al, 1999). Though the overall incidence of anomalous origin of prevertebral segment of vertebral artery is low, it is extremely important to be aware of these complications in patients with this anomaly. Also Nanthan & Seidal, 1993 had reported a left vertebral artery of aortic origin associated with retrooesophageal right subclavian artery and thoracic duct terminating on right side, yet with normal origin of right vertebral artery.

Komiyana et al, (2001) reported the incidence of arterial dissection of the vertebral artery of aortic origin and vertebral artery of subclavian origin. According to their studies left vertebral artery of aortic origin was associated with a significantly higher incidence of vertebral artery dissection than left vertebral artery of left subclavian artery origin and right vertebral artery of right subclavian origin.

In our observations the diameter of left vertebral artery was 3.1 mm at origin while it was 6.5 mm on right side. Earlier studies by Pasturet, 1958 had reported that left vertebral artery of <3.5 mm diameter may be considered hypoplastic (Matula et al, 1997).

A significant observation in the present study was the absence of inferior thyroid artery. The arterial supply of thyroid gland was completely replaced by superior thyroid artery, which was long, wide and reaching up to the inferior pole of thyroid gland. Yilmaz et al, 1993 had reported an anomaly in which inferior thyroid arteries were absent but were replaced by arteria thyroidea ima, which arose from brachiocephalic trunk. No such branch was seen arising from aortic arch in present study. (Photograph B).

Embryological Basis

Usually the first part of vertebral artery develops from proximal part of dorsal branch of seventh cervical intersegmental artery proximal to postcostal anastomosis. The second part is derived from longitudinal communications of the postcostal anastomoses. (Fig. 3) In the present case left sixth dorsal intersegmental artery might have persisted as first part of vertebral artery hence left vertebral artery is arising from arch of aorta. (Fig. 4)

According to Vorster et al, 1998, the proximal parts of the segmental arteries are exposed to longitudinal tension and bending due to caudal shifting of the aorta resulting in retarded blood flow and abnormal connections between longitudinal channels (vertebral artery) and subclavian artery or aorta.

In summary, it is therefore important to be aware of this rare variation in the origin and course of left vertebral artery and absence of inferior thyroid artery as it might have serious implication in surgical and angiographic procedures.

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References:

Fig. 1. Showing The Origin Of Right Vertebral Artery From Subclavian Artery

Fig. 2. Showing The Origin Of Left Vertebral Artery From Aortic Arch
Fig. 3. Diagramatic Representation Of Intersegmental Arteries (Fetal Stage) Cephalic end of the Fetus.

Fig. 4. Schematic Representation of Arch Arteries Along With Ventral And Dorsal Aorta. 6th Arch artery is Darkly Painted.