

A Cadaveric Study of Variations in the Origin and Course of Vertebral Artery

R. Deepa

Tutor, Department of Anatomy, Government Dharmapuri Medical College, Dharmapuri, Tamilnadu, India

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Corresponding author: Dr. R. Deepa

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Abstract:

Arterial variations are constantly very frequently seen in different arteries of the body and they are very significant from surgical and diagnostic point of view. Aim of this study is to find variations in the origin and course of vertebral artery. The vertebral arteries are major arteries of the neck. The vertebral arteries and their major branches, i.e. vertebrobasilar system, essentially supply blood to the upper spinal cord, the brain stem and cerebellum and variable parts of posterior cerebral hemispheres. Many types of variations in the origin and course of vertebral artery were found. The operative indication for surgery in the cervical region include spondylosis, a herniated intervertebral disc, tumor, infection and trauma. So, apart from knowing the clinical associations, the information which is consequential from the gross anatomical dissections of cadavers can be a valuable guide to the doctors for cautious pre-operative preparation in patients with an unusual course of vertebral artery and can help them in avoiding potentially life threatening complications.

Keywords: Vertebral Artery, Foramina Transversaria.

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Introduction

The vertebral arteries are major arteries of the neck. The vertebral arteries and their major branches, i.e. vertebro-basilar system, fundamentally supplies blood to the upper spinal cord, the brain stem and cerebellum and variable parts of posterior cerebral hemispheres. The vertebral arteries are normally derived from the subclavian arteries. After taking origin from the subclavian arteries; the vertebral arteries rise through the neck in the foramina transversaria from C6 upwards up to C1 vertebrae and enter the cranial cavity through the foramen magnum, nearby to the anterolateral aspect of the medulla. They converge medially as they go up over the medulla and join to form the midline basilar artery at the level of the junction between the pons and medulla. The passage of the vertebral artery is distributed into four parts as follows:

The first part extends from its origin from the subclavian artery to reach the transverse process of C6. The second part runs up through the foramen transversarium of the C6 to C1 vertebrae. The third part lies in the suboccipital triangle. It arises from the foramen transversarium of C1, winds around the posterior aspect of the lateral mass of atlas, runs medially lying on posterior arch of C1 and enters the vertebral canal. The fourth part extends from the posterior atlantooccipital membrane to the

lower border of pons. Numerous variants are found in the origin and course of the vertebral artery.

Generally it enters into go into the foramen transversarium of C6 and passes up but sometimes it may go into foramen transversarium of any other cervical vertebrae[1,2]. Also, occasionally the vertebral artery takes its origin directly from the arch of aorta as an alternative of subclavian artery. These variations, if present, are important from the diagnostic as well as surgical point of view[3,5]. The surgical indications in the cervical region include spondylosis, a herniated disc, tumor and trauma.

The failure to recognize the variances during the preoperative assessment can end up in on table difficulty like laceration of the vertebral artery during anterior cervical spinal surgery. So, apart from taking into consideration the clinical consequences, the data which is derived from the gross anatomical dissections of cadavers can be a helpful guide to the operating surgeons for careful pre-operative assessment and will help in escaping possible life threatening complications[1].

In our study we are planning to evaluate possible variation that is identified in cadavers in vertebral artery.

Material and Methods

We included cadavers embalmed in 10% formalin from Department of Anatomy, Government Dharmapuri Medical College, Dharmapuri. 30 cadavers were accessible to study the variations in the origin and course of the vertebral artery. Dissection was carried out in the scaleno-vertebral region on both the sides, so a total of 60 vertebral arteries were dissected. The prevertebral segment of the vertebral artery as well as the entrance and course of vertebral artery into foramina transversaria was assessed. Variations in the origin, as well as course of vertebral artery, were distinguished and images were taken.

Observations and Results

Multiple variations were found in the origin and course of vertebral artery in our study. These

variations were noted down as follows. To start with Variations in the origin of vertebral artery were found in three cases out of 30 cases dissected. The left vertebral artery was arising as a common stem with Subclavian artery from the arch of aorta in one case. The common stem was measuring about 1cm in length. Left Vertebral artery was arising directly from the arch of aorta instead of arising from Subclavian artery in two cases.

Variation in the course of vertebral artery was found in three cases. In two cases the variation in the course of vertebral artery was found to be unilateral. Left vertebral artery was entering into the foramen transversarium of C3 in two cases. Two cases showed the bilateral variation in the course of vertebral artery. Right sided vertebral artery was entering into the foramen transversarium of C5 while on the left side it was entering into the foramen transversarium of C7 in both the cases.

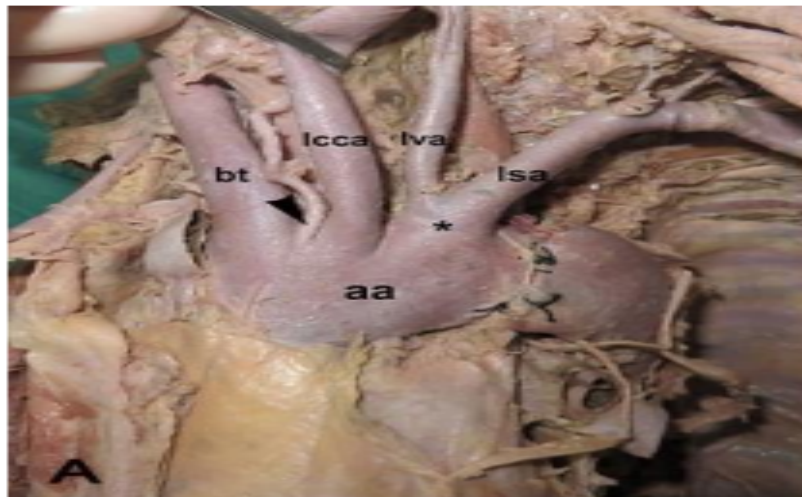


Figure 1: Vertebral from arch of aorta

Discussion

In this study it was also observed that there was a common stem for left subclavian artery and left vertebral artery, arising from arch of aorta. This type of variation was observed in 2.5% cases. Panicker et al[2] reported the origin of vertebral artery from arch of aorta in 5 percent of cases, while.

Gorey AR et al[4] stated that the most frequent variant is the left vertebral artery arising directly from arch of aorta between left common carotid and left subclavian arteries which accounts to about 2.4-5.8 percent of cases[6]. In this study also entrance of vertebral artery into different foramina transversaria other than normal. Vertebral artery was entering into the foramen transversarium of C7 was found in 5% of cases.

Vertebral artery entering into the foramen transversarium of C5 was observed in 5% of cases.

Aprajita Sikka and Anjali Jain[7] found the origin of left vertebral artery from the arch of aorta between the left common carotid artery and the left subclavian artery and entered the foramen transversarium of the fourth cervical vertebra, Similarly Rawal Jitendra D et al[8] dissected 50 vertebral arteries, and found 46 vertebral arteries entering the transverse foramen of the sixth cervical vertebra (92%) and 4 of them entering transverse process of seventh cervical vertebra (8%). The explanation behind this may be due embryological development, normally at the end of the third week of development, small posterolateral sprouts arise from the dorsal aorta at the cervical through sacral level and grow into spaces between the developing somites.

In the cervical region, the intersegmental sprouts form vertical anastomosis with each other, secondarily lose their intersegmental connections to form vertebral arteries.[9-11] Also in the fourth

week of development vertebrae are produced from the sclerotomes. Due to resegmentation of the sclerotomes, intersegmental arteries at first lying amid the sclerotomes now pass midway over vertebral bodies. When the vertebral arch fuses with body, the vertebral artery, formed from intersegmental anastomosis is enclosed into foramina transversaria of cervical vertebrae. Alteration in this development ends up in entry of vertebral artery into different foramina transversaria.[12]

Conclusion

Variations in the origin of left vertebral artery are essential and helpful for planning of aortic arch surgery or endovascular intervention, surgical procedures that would require exposure of vertebral artery, include repair of aneurysms, excisions of craniocervical junction masses, vertebral artery bypass surgery, and bony decompression of the vertebral artery. Also, anatomical variation in vertebral artery, if missed, can lead to catastrophic sequelae in different surgeries. Advances in technology have increased our knowledge regarding different variations in our body and an awareness regarding them can help avoid unwanted complications during various interventions.

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