

Case report**ANOMALOUS PREVERTEBRAL COURSE OF THE LEFT VERTEBRAL ARTERY****Prakash Billakanti Babu***Anatomy Department, Kasturba Medical College, Manipal University, Manipal, Karnataka, India***RESUMEN**

La arteria vertebral es una de las arterias que irriga el cerebro. El conocimiento de la anatomía normal y las variantes de la arteria vertebral adquiere importancia en la práctica clínica y la radiología vascular. El origen anómalo de la arteria vertebral del arco de la aorta o cualquiera de las arterias del cuello ha sido reportado por muchos autores. En este informe se presenta una variación del curso prevertebral de la arteria vertebral izquierda. La arteria vertebral tenía su origen habitual en la arteria subclavia con un largo curso prevertebral y entraba en el foramen transversarium de la vértebra CII. El origen y recorrido de la arteria vertebral en el lado derecho fue normal. Clínicamente es importante conocer el origen y curso del segmento prevertebral de la arteria vertebral y las posibles variaciones. El presente informe debería ser de interés para el médico vascular con respecto a las variaciones en el cuello y región torácica, y puede dar idea para dilucidar el mecanismo de desarrollo de la angiogénesis.

Palabras clave: *Anomalías arteriales, ramas de la arteria subclavia.*

ABSTRACT

Vertebral artery is one of the arteries supplying the brain. Knowledge of the normal and variant anatomy of the vertebral artery assumes importance in clinical practice and vascular radiology. Anomalous origins of the vertebral artery from the arch of the aorta or any one of the arteries of the neck have been reported by several authors. In this report a variation of the prevertebral course of the left vertebral artery is being presented. The Vertebral artery had usual origin from the subclavian artery and had a longer prevertebral course to enter the foramen transversarium of the CII vertebra. The origin and course of the vertebral artery on the right side was normal. It is clinically important to

know the origin and course of the prevertebral segment of the vertebral artery and possible variations. The present report should be of interest for clinicians with regard to vascular variations in the neck and thoracic region, and may give insight into elucidating the developmental mechanism of angiogenesis.

Key words: *Arterial anomalies, branches of the subclavian artery*

INTRODUCTION

The vertebral artery (VA) is the largest branch arising from superior aspect of the first part of subclavian artery, medial to scalenus anterior muscle. The artery courses upwards and enters into the transverse foramina of upper six cervical vertebra (Moore, 1982; Matula et al, 1997). It ascends through the transverse foramina of the upper six cervical vertebrae. It emerges from the transverse foramen of atlas and turns postero-medially on its posterior arch, passes deep to the free border of posterior atlantooccipital membrane and enters the foramen magnum to reach posterior cranial fossa. At lower border of pons it unites with the opposite VA to form the basilar artery.

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The portion of the VA from its origin to its respective transverse foramen is called the prevertebral segment (Matula et al, 1997). Although the VA is described as the first branch of the subclavian artery, multiple variations in the origin of the vessel have been reported in the

literature (Goray et al, 2005; Strub et al, 2006). Knowledge of the variation of the origin of VA and its prevertebral course is important for head and neck surgery and vascular angiography (as reported by Milgliche and Issac, 1978; Newton and Mani, 1978; Bernardi and Dettori, 1975).

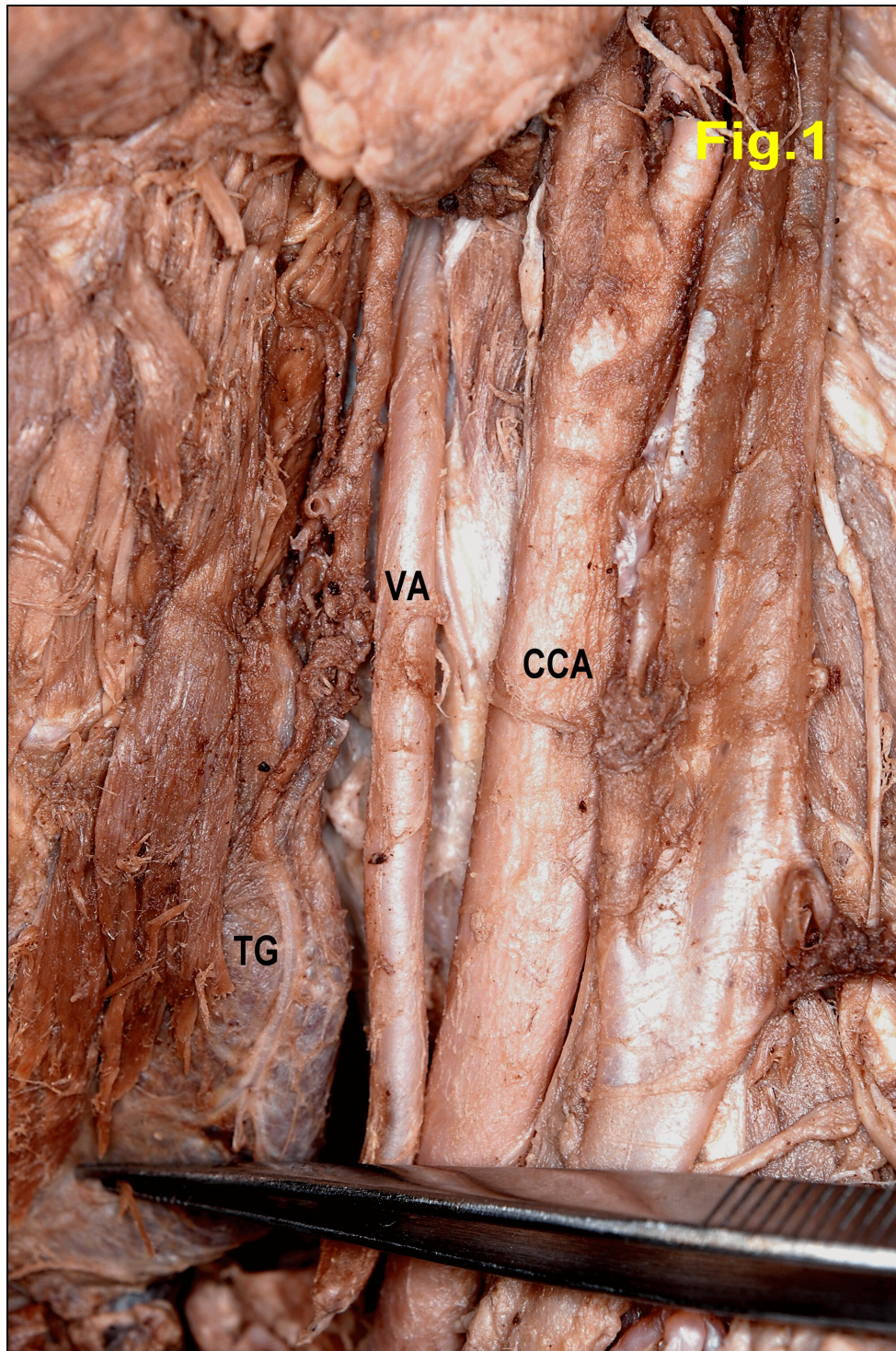


Figure 1- Anomalous prevertebral course of Left vertebral artery showing: CA: Common carotid artery; VA: vertebral artery; TG: Thyroid gland.

CASE REPORT

During a routine dissection for undergraduates in an adult male cadaver in the Department of Anatomy, Kasturba Medical College Manipal, an unusual course of the prevertebral segment in the left vertebral artery was observed. The artery was carefully dissected and photographed. Left vertebral artery was found arising directly from the arch of aorta in the interval between the left common carotid and left subclavian arteries (Fig.1). After its origin, the artery was running upwards behind left common carotid artery, left lobe of thyroid gland and in front of prevertebral muscles to enter the foramen transversarium of the second cervical vertebra. However, the right vertebral artery arose from the first part of the subclavian artery, as usual.

DISCUSSION

The anatomic and morphological variations of the VA are important for diagnostic and all non-invasive procedures in Head and Neck regions as reported by Matula et al (1997). The prevertebral segment of VA is frequently affected by atherosclerosis as reported by Gluncic et al (1999). As overall incidences of anomalies in the prevertebral segment of VA are very low, it is extremely important to be aware of this aspect in a patient with this anomaly. Thus it is important to know the origin and course of prevertebral segment of VA and its possible variations. To prevent any complication, it is essential to assess vascularization of this region prior of conducting medical procedures. During its course in the neck the VA usually enters the foramen transversarium of CVI. Fazan et al (2004) in their study reported abnormal origin of the right VA from right common carotid artery at the inferior border of thyroid gland and in its cervical course the VA passes upwards outside and anteriorly to the foramen transversarium of CVI to C III vertebra and enters foramen transversarium of CII vertebra. Studies by Jackson et al (2000) reported a case where left VA is entering the foramen transversarium of CIII vertebra.

According to previous reports available the entry of the VA into the foramen transversarium is variable: Rieger and Huber (1983) in their study observed the entry of the VA at the level of CVI in 88%, CV in 7%, CIV in 10.5% and CVII in 5.4%. Adachi (1928) in his studies of 1,000 half heads, found the VA entering the foramen transversarium at CV, CVII and CIV in 4.5%, 1.2% and 0.7%, respectively. The final configuration of the arch of aorta and its branches is related to its

associated "migration" and "merging" of the branches, together with the different growth rates in various arteries as cited by Layton et al (2006). Variant origin of vertebral artery is attributed to the altered development of certain branchial arch arteries during the embryonic period of gestation as cited by Nayak et al (2006). Inter-segmental arteries are 30 or more and are branches of the dorsal aorta. They originate from the branchial aortic system. Usually the first part of vertebral artery develops from proximal part of dorsal branch of seventh cervical inter segmental artery proximal to post costal anastomosis. The second part is derived from longitudinal communications of the post costal anastomosis of intersegmental arteries. In the present case, the prevertebral segment entering CII vertebra may due to precostal anastomosis between CVI to CIII.

Matula et al (1997) in their study found level of entry of the VA into the foramen transversarium of CVI in 90%. They also found in one case each of the VA entering at CIV and CV and in two cases VA entering at the level of C VII. They have also reported the origin of right VA from external carotid artery and entering CIII. Because of its relationship to common carotid artery, VA could be damaged during surgical procedures especially those employing carotid clamping or by-pass techniques. Studies by Heary et al, (1996) have reported VA entering into the foramen transversarium of the CVI in 100% of their series. In study series conducted by Ranganath et al (2006) VA entered the foramen transversarium of CVI in 71.1% of cases in adults and in 95% of cases in fetuses. Jackson et al, (2000) in their study have described one case of a left VA entering the foramen transversarium of CIII vertebrae. Only two other reports of VA entering at the level of CIII were of Fujiyama et al (1994) and Gluncic et al (1999). Fazan et al (2004) described a rare case of the VA of right side originating from the common carotid artery and entering the foramen transversarium of CII. Knowing the origin and course of the prevertebral segment of the VA in detail is of great importance for head and neck surgery and vascular angiography. The abnormal origin of vertebral artery may favor cerebral disorders because of alterations in cerebral hemodynamics as reported by Bernardi and Dettori (1975).

An understanding of the anatomy of these arteries and the adjacent bony anatomy is essential to prevent iatrogenic VA injuries as reported by Heary et al (1996). In the presence of an abnormally tortuous VA, using anatomic landmarks to guide decompression may not prevent iatrogenic injury to the VA. Failure to recognize this anomaly during preoperative planning can lead to the laceration of the vessel.

Laceration of the VA is the most challenging surgical dilemma during anterior cervical spine surgery; gaining control of the massive hemorrhage from a ruptured VA is difficult and could possibly result in an uncertain neurological morbidity as reported by Lu and Ebraheim (1999). A knowledge of this variation should be kept in mind while performing diagnostic investigations or performing surgical procedures in head and neck region as reported by Matula et al (1997) and Gluncic et al (1999). In order to prevent complications, it is critical to assess vascularization in this region prior to conducting medical procedures. Studies by Goray et al (2005) reported that knowledge of these findings is important not only in diagnostic angiography and color coded Doppler sonography but also in surgical and endovascular treatment.

REFERENCES

- Adachi B.* 1928. Das Arteriensystem der Japaner. Kyoto, Maruzen 1: 138–54.
- Bernardi L, Dettori P.* 1975. Angiographic study of a rare anomalous origin of the vertebral artery. *Neuroradiology* 9: 43–47.
- Fazan VP, Caetano AG, Filho OA.* 2004. Anomalous origin and cervical course of the vertebral artery in the presence of a retro esophageal right subclavian artery. *Clin Anat* 17: 344–47.
- Fujiyama K, Motomura M, Shirabe S, Nakamura T, Isomoto I, Shibayama K.* 1994. Locked in syndrome and abnormal orientation of the right vertebral artery in a young man. *Intern Med* 33: 476–80.
- Gluncic V, Ivkic G, Marin D, Percac S.* 1999. Anomalous origin of both vertebral arteries. *Clin Anat* 12: 281–84.
- Goray VB, Joshi AR, Garg A, Merchant S, Yadav B, Maheshwari P.* 2005. Aortic arch variation: a unique case with anomalous origin of both vertebral arteries as additional branches of the aortic arch distal to left subclavian artery. *AJNR Am J Neuroradiol* 26: 93–95.
- Heary RF, Albert TJ, Ludwig SC, Vaccaro AR, Wolansky LJ, Leddy TP.* 1996. Surgical anatomy of the vertebral arteries. *Spine* 21: 2074–80.
- Jackson RS, Wheeler AH, Darden BV.* 2000. 2nd Vertebral artery anomaly with a traumatic dissection causing thromboembolic ischemia: A case report. *Spine*. 25: 1989–92.
- Lu J, Ebraheim NA.* 1999. The vertebral artery: Surgical anatomy. *Orthopedics* 22: 1081–85.
- Layton KF, Kallmes DF, Cloft HJ, Lindell EP, Cox VS.* 2006. Bovine Aortic Arch Variant In Humans: Clarification of a Common Misnomer. *Am J Neuroradiol* 27:1541–42.
- Matula C, Trattig S, Tschabitscher M, Day JD, Koos WT.* 1997. The course of the prevertebral segment of the vertebral artery: anatomy and clinical significance. *Surg Neurol* 48: 125–31.
- Milgliche NL, Isaac ND.* 2009. A three branches aortic arch variant with a bi-carotid trunk and a retro-oesophageal right subclavian artery. *IJAV* 2: 11–14.
- Moore KL.* 1982. The Developing Human Clinically Oriented Embryology. 3rd ed: Philadelphia.p 291–318.
- Nayak SR, Pai MM, Prabhu LV, D Costa S, Shetty P.* 2006. Anatomical organization of aortic arch variations in the India: embryological basis and review. *J Vasc Bras* 5: 95–100.
- Newton TH, Mani R.* 1978. The vertebral artery. In: Newton TH, Potts DG, eds. *Radiology of the skull and brain*. St. Louis, Mosby: 1659–1709.
- Ranganath SV, Manjunath KY.* 2006. The course of the VI segment of vertebral. *Annals of Indian Academy of Neurology* 9: 223–26.
- Rieger P, Huber G.* 1983. Fenestration and duplicate origin of the left vertebral artery in angiography. *Neuroradiology* 25: 45–50.
- Strub WM, Tomsick TA, Leach JL.* 2006. Left vertebral artery origin from the thyrocervical trunk: a unique vascular variant. *AJNR Am J Neuroradiol* 27: 1155–56.