

Anomalous Origin of Right Vertebral Artery from Common Carotid Artery with Abberant Right Subclavian Artery in a Case of Carcinoma Lung

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Abstract: ***Aim:** To highlight the importance of reporting normal anatomical variations in the origin of the vertebral artery. **Background:** The vertebral artery is the first branch of the subclavian artery and arises from its superior surface. Numerous variations in the origin of the vertebral artery have been described, however the origin of right vertebral artery from common carotid artery associated with an aberrant right subclavian artery is not very common. We present the case of a 60-year-old male who was diagnosed to have carcinoma of lung on CT study and incidentally detected to have anomalous origin of right vertebral artery. We also discuss the relevant embryology and its clinical implications.*

1. Case Description

A 60-year-old male presented with complaints of cough and haemoptysis. A CT study was performed which revealed a neoplastic mass in the right hilar region. The arterial phase images revealed anomalous origin of right vertebral artery from the common carotid artery. In addition, an aberrant right subclavian artery was seen with a retroesophageal course.



Figure 1

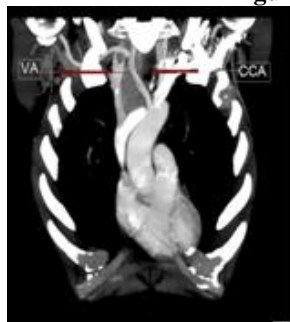


Figure 2



Figure 3

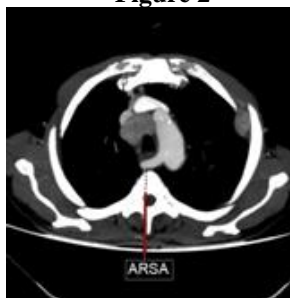


Figure 4



Figure 5

Figures 1, 2 and 3- Postcontrast coronal and sagittal images reveal anomalous origin of the right vertebral artery from the right common carotid artery.

Figure 4- Postcontrast sagittal image reveals aberrant right subclavian artery with a retroesophageal course.

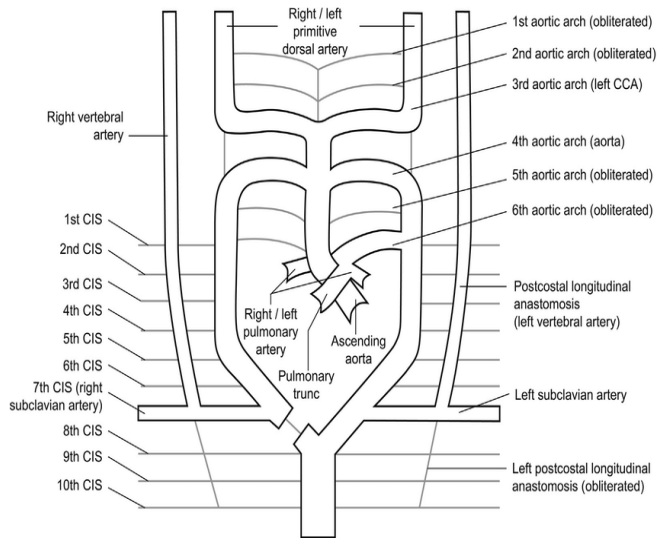
Figure 5- Postcontrast coronal image reveals neoplastic right hilar mass with intrapulmonary and lymph nodal metastasis.

2. Discussion

The vertebral artery is the first branch of the subclavian artery, arises from its supero-posterior aspect, and enters the foramen transversarium of the C6 vertebral body, courses superiorly up to the foramen transversarium of C1 vertebral body, then curves medially behind the lateral mass of atlas and enters the cranium via the foramen magnum at the lower border of the pons and unites with the contralateral vertebral artery forming the basilar artery¹. Numerous variations in the origin as well of the course of the vertebral arteries have been described in the literature. Some of the variants of vertebral artery origin include a common trunk with the thyrocervical trunk (3.0%), an aortic origin of the left vertebral artery (2.5%, arising between the left common carotid artery and the left subclavian artery), a right vertebral artery arising at the site of bifurcation of the innominate artery into right subclavian and right common carotid artery (1.1%), and a right vertebral artery as a direct branch of the right common carotid artery (0.3%)².

During development, longitudinal anastomoses are formed between the eight cervical segmental arteries³. The cervical portion of the vertebral artery is formed by a series of longitudinal anastomosis between the upper seven dorsal segmental arteries and the disappearance of the proximal portions of the upper six segmental arteries. The seventh pair of segmental arteries take part in the formation of the subclavian artery, the left forming the entire left subclavian and the right a considerable portion of the right⁴. Failure of involution in one of the first six cervical intersegment arteries causes a variety of abnormal origins of the vertebral artery⁵. Persistence of the right sixth segmental artery results in anomalous origin of the right vertebral artery from the common carotid artery. Because of the persistent lower cervical intersegment artery, the vertebral artery comes in contact with the proximal dorsal aorta and fourth aortic arch,

which in turn connects to the common carotid artery; and because of the involution of the ipsilateral middle dorsal aorta, the remaining ipsilateral seventh cervical intersegment arteries connects to the contralateral dorsal aorta, which results in an ipsilateral aberrant subclavian artery⁶.



Schematic diagram shows normal development of the aorta and vertebral arteries⁷.

3. Conclusion

Numerous variations have been described in the origin and course of the vertebral artery. Many times, these anomalies are detected as incidental findings, however it is important for the radiologist to know and report these anomalies as it can warn the vascular interventionalist, vascular surgeons and neck surgeon about its anomalous course and prevent iatrogenic injury. Even though aberrant origin of the right vertebral artery from the common carotid artery may be an incidental finding it is important for the radiologist to report this anomaly so that neuro interventionalist, vascular or neck surgeons are aware of its anomalous course and the necessary steps to prevent vascular injury and its complications.

4. Clinical Significance

Knowledge of the precise origin of anomalous vertebral arteries can be critical before the performance of surgical or endovascular procedures. Surgeons unaware of vertebral artery variations can encounter fatal haemorrhage during operations such as thyroidectomy or excision of a pharyngeal diverticulum where he can accidentally tear the vertebral artery while attempting ligation of the inferior thyroid artery or may cause destruction of any adjacent important structures such as the brachial plexus, thoracic duct, common carotid artery, jugular vein⁸. Patients with vertebral artery anomalies may present with symptoms of vertebral basilar insufficiency⁹.

Occlusion of the common carotid artery proximal to the origin of the vertebral artery may not only lead to infarcts in the territory of the right anterior, middle cerebral arteries but also to infarcts in the medulla. Also, emboli from the

common carotid artery can enter the posterior circulation, thus affecting both anterior and posterior circulation of the brain. Common carotid artery ligation may be performed in cases of carotid artery aneurysms, carotid body tumour or to prevent bleeding. Arterial collateralisation after CCA ligation occurs via collaterals from the right vertebral artery to the external carotid artery. Retrograde blood flow occurs around the carotid bifurcation once again filling the internal carotid system. Collateral circulation to the internal carotid system also occurs via the posterior communicating artery from the vertebrobasilar circulation¹⁰. Thus, in cases of ligation or occlusion of the common carotid artery, proximal to the origin of the vertebral artery development of these collaterals is also hampered when the vertebral artery arises directly from the common carotid artery. Atherosclerotic disease can occur in close proximity to an aberrant vertebral artery origin. When an aberrant subclavian artery is detected it is necessary for the radiologist to look for associated vertebral artery anomalies.

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