

Two Cases of Aberrant Vertebral Artery Originating from Aortic Arch Distal to Left Subclavian Artery¹

좌측 쇄골하동맥 원위부 대동맥궁에서 기시한 미입척추동맥 2예¹

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We report two cases of the aberrant vertebral artery, which originated from the part of the aortic arch about 2.5 cm distal to the left of the subclavian artery origin. The aberrant vertebral arteries were relatively hypoplastic. Herein, we review the previous reported cases in the literature and discuss embryologic basis and clinical implication of this variation.

Index terms

Vertebral Artery

Aberrant Origin

Computed Tomography Angiography

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INTRODUCTION

The variations of the vertebral artery (VA) are very diverse in its origin and course. Particularly, the origin of the VA from the part of the aortic arch, distal to the origin of the left subclavian artery (SCA), is very rare. We experienced two cases of this variation. Herein, we describe the two cases and review the relative previous reports, which described this variation. We review the embryologic background and the clinical implication of this variation.

CASE REPORT

Case 1

A 72-year-old female patient visited our hospital due to severe headache. She had no history of major medical problems. Computed tomographic angiography (CTA) was performed because carotid bruit was suspected in the left side. On CTA, there was no significant stenosis of the carotid arteries. However, unexpectedly, right VA originated directly from the medial wall of the aortic arch, which was about 2.5 cm distal to the left SCA (Fig. 1). The right VA, which was hypoplastic, coursed behind the esoph-

agus and the trachea in front of the 3rd thoracic vertebral body, and ascended upward along the posterior mediastinum. Then, it entered the right transverse foramen of the 7th cervical vertebra. The origin and course of the left VA were normal.

Case 2

An 82-year-old male patient visited our hospital, due to transient right side weakness. Imaging studies, including magnetic resonance angiography (MRA), was performed under the clinical impression of the transient ischemic attack. Imaging studies showed no remarkable abnormalities. However, the left side VA, which was hypoplastic, originated directly from the part of the aortic arch, which was about 2.6 cm distal to the left SCA origin (Fig. 2). The level of the entrance to the transverse foramen could not be evaluated on MRA. Ascending aorta showed a mild dilatation (diameter more than 4 cm). The origin and course of the right VA were normal.

DISCUSSION

The origin of the left VA directly from the aortic arch be-



Fig. 1. Images from a 72-year-old woman with severe headache. Aberrant right vertebral artery (arrows) arises directly from the proximal descending thoracic aorta, distal to the left subclavian artery. It courses behind the esophagus and the trachea (A) in front of the 3rd thoracic vertebral body, and ascends upward along the posterior mediastinum (B). Then, it enters the right transverse foramen of the 7th cervical vertebra (C).

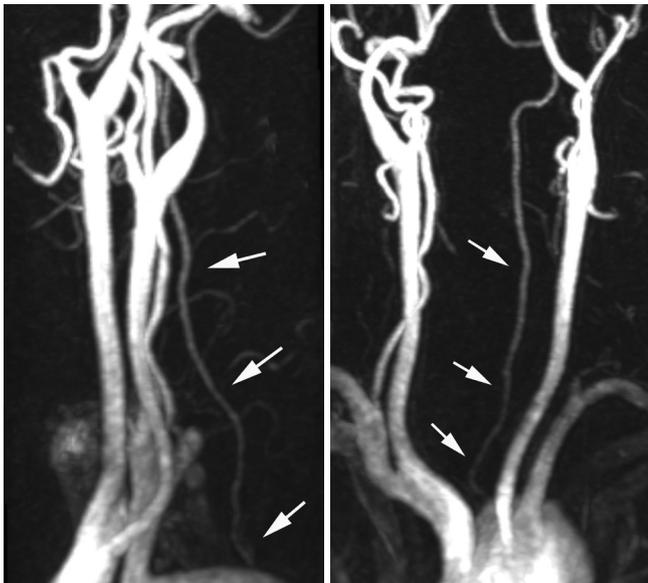


Fig. 2. Images from an 82-year-old man with transient right side weakness. Aberrant left vertebral artery (arrows) arises directly from the aortic arch about 2.6 cm distal to left subclavian artery. It ascends upward along the posterior mediastinum. It is relatively hypoplastic. Ascending aorta shows mild aneurysmal dilatation. The level of the entrance cannot be determined on magnetic resonance angiography.

tween the left common carotid artery and left SCA was reported in 2.4% to 5.8% of cases (1). But the variation of the right VA from the aortic arch is rarer than the left VA. The previously described anomalous origins of the right VA were classified into three groups: 1) those arising from the carotid arteries, 2) those originating directly from the aorta like this case, and also 3) those of duplicated origin (1). We summarized the 13 previous cases with the origin of the VA arising from the part of the aortic arch, distal to the origin of left SCA in Table 1.

To understand the hypothetical development of anomalous origin of the VA, background knowledge of the embryologic development of the VA is essential. The earliest development of the VA occurs when the embryo is at the 7 mm stage. At the 7 mm stage, there are eight cervical intersegmental arteries (IAs), which originate from each of the paired ventral aorta. At the 10 to 12 mm stage, a longitudinal anastomosis develops between the primitive cervical IAs by involution of the vertebral segments of these arteries. Then, the remaining longitudinal anastomoses become both vertebral arteries. In other words, the VA originated from the 7th cervical IA, and the obliteration of the distal part of the dorsal aorta, which connected with the 7th cervical IA, makes normal aorta and SCA (1). However, if the right VA arises from the 8th IA and the obliteration of right dorsal aorta occurs between 7th and 8th cervical IA, the right side variation is explained. The left side variation can be explained by the persistence of the 8th IA. In our case 1, the right VA entered the transverse foramen of the 7th cervical vertebra. In the previous reports, entrance of the VA to the C7 transverse foramen was very rare (2.5%) (2). The level of VA entrance into the transverse foramen of cervical vertebra may be determined by the level of the cervical IA from which the VA developed (3). In our case 1, the entrance of the right VA to the 7th transverse foramen is concordant with this theory.

In most cases, anomalous VA origins did not cause clinical symptoms, and these abnormalities were incidentally found in the course of image screening, such as CTA or MRA. There is no definitive evidence that these abnormalities result in a cere-

Table 1. Review of the Variation of the Right Vertebral Artery Arising from Aortic Arch Distal to Left Subclavian Artery

Reference	Year	Description of Anomalies		
		Left VA	Right VA	Other
Schwarzacher and Krammer (3)	1989	From between left CCA and left SCA	From the distal branch of aortic arch	
Lemke et al. (1)	1999		From the distal branch of aortic arch	
Karcaaltincaba et al. (4)	2003	From between left CCA and left SCA	From the distal branch of aortic arch	
Goray et al. (5)	2005	Both VAs arising from the distal branch of aortic arch (C7 TF)		
Satti et al. (6)	2007		From the distal branch of aortic arch	
Son et al. (7)	2008	From the distal branch of aortic arch		(Combined with pseudocoarctation)
Hsu et al. (8)	2010		Double origin, one arising from the right SCA as usual and the other from the distal branch of aortic arch	
		Both VAs arising from the distal branch of aortic arch (enter the C7 TF)		
Verin et al. (9)	2010	Directly arising between the left CCA and the proximal part of left SCA	From the distal branch of aortic arch	Cervical aortic arch arising above the manubrium sterni. A common trunk between the right brachiocephalic artery and the left CCA
Lacout et al. (10)	2012		From the distal branch of aortic arch (C7 TF)	

Note.—CCA = common carotid artery, SCA = subclavian artery, TF = transverse foramen, VA = vertebral artery

brovascular disorders. However, these anomalous origins can lead to changes in cerebrovascular hemodynamics that may cause cerebrovascular disorders if the aortic arch diseases, such as the dissection, occur. In our cases, the origin of the aberrant VA was within about 2.5 cm distal to the origin of the left SCA. Knowing this aberrant VA may be helpful for planning surgery or endovascular intervention for the aortic dissection or for performing diagnostic cerebral angiography. Therefore, detailed knowledge of an anomalous origin of VA is needed and the presence of such a variant always must be taken into consideration.

In summary, although anomalous origins of the VA are only anatomic variants, detailed information of these is important for the vascular surgery and endovascular procedure near the aortic arch.

REFERENCES

- Lemke AJ, Benndorf G, Liebig T, Felix R. Anomalous origin of the right vertebral artery: review of the literature and case report of right vertebral artery origin distal to the left subclavian artery. *AJNR Am J Neuroradiol* 1999;20:1318-1321
- Lasjaunias PL, Berenstein A, Brugge KGt. Spinal and spinal cord arteries and veins. In Lasjaunias PL, Berenstein A, Brugge KGt. *Surgical neuroangiography*, 2nd ed. Berlin, New York: Springer, 2001:82
- Schwarzacher SW, Krammer EB. Complex anomalies of the human aortic arch system: unique case with both vertebral arteries as additional branches of the aortic arch. *Anat Rec* 1989;225:246-250
- Karcaaltincaba M, Strotzman J, Washington L. Multidetector-row CT angiographic findings in the bilateral aortic arch origin of the vertebral arteries. *AJNR Am J Neuroradiol* 2003;24:157
- Goray VB, Joshi AR, Garg A, Merchant S, Yadav B, Maheshwari P. 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* 2005;26:93-95
- Satti SR, Cerniglia CA, Koenigsberg RA. Cervical vertebral artery variations: an anatomic study. *AJNR Am J Neuroradiol* 2007;28:976-980
- Son JS, Hong KB, Chung DC. Pseudocoarctation of the aorta associated with the anomalous origin of the left vertebral artery: a case report. *Korean J Radiol* 2008;9:

- 283-285
8. Hsu DP, Alexander AD, Gilkeson RC. Anomalous vertebral artery origins: the first and second reports of two variants. *J Neurointerv Surg* 2010;2:160-162
9. Verin AL, Creuze N, Musset D. Multidetector CT scan findings of a right aberrant retroesophageal vertebral artery with an anomalous origin from a cervical aortic arch. *Chest* 2010;138:418-422
10. Lacout A, Khalil A, Figl A, Liloku R, Marcy PY. Vertebral arteria lusoria: a life-threatening condition for oesophageal surgery. *Surg Radiol Anat* 2012;34:381-383

좌측 쇄골하동맥 원위부 대동맥궁에서 기시한 미입척추동맥 2예¹

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좌측 쇄골하동맥 원위부 대동맥궁에서 기시하는 미입척추동맥은 매우 드문 해부학적 변이이다. 저자들은 2예의 드문 좌측 쇄골하동맥의 약 2.5 cm 원위부 대동맥궁에서 기시한 미입척추동맥을 경험하였다. 미입척추동맥은 정상위치의 동맥에 비해 상대적으로 형성부전을 보였다. 우리는 발생학적 기전 및 이러한 변이의 임상적 의미에 대해 보고자 한다.

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