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 review the previous reported cases in the literature and discuss embryologic basis and 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 esophagus 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-
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 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

<table>
<thead>
<tr>
<th>Reference</th>
<th>Year</th>
<th>Description of Anomalies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schwarzacher and Krammer (3)</td>
<td>1989</td>
<td>From between left CCA and left SCA</td>
</tr>
<tr>
<td>Lemke et al. (1)</td>
<td>1999</td>
<td>From the distal branch of aortic arch</td>
</tr>
<tr>
<td>Karcaaltincaba et al. (4)</td>
<td>2003</td>
<td>From between left CCA and left SCA</td>
</tr>
<tr>
<td>Goray et al. (5)</td>
<td>2005</td>
<td>Both VAs arising from the distal branch of aortic arch (C7 TF)</td>
</tr>
<tr>
<td>Satti et al. (6)</td>
<td>2007</td>
<td>From the distal branch of aortic arch</td>
</tr>
<tr>
<td>Son et al. (7)</td>
<td>2008</td>
<td>From the distal branch of aortic arch</td>
</tr>
<tr>
<td>Hsu et al. (8)</td>
<td>2010</td>
<td>Double origin, one arising from the right SCA as usual and the other from the distal branch of aortic arch</td>
</tr>
<tr>
<td>Verin et al. (9)</td>
<td>2010</td>
<td>Directly arising between the left CCA and the proximal part of left SCA</td>
</tr>
<tr>
<td>Lacout et al. (10)</td>
<td>2012</td>
<td>From the distal branch of aortic arch (C7 TF)</td>
</tr>
</tbody>
</table>

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

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좌측 쇄골하동맥 원위부 대동맥궁에서 기시한 미입척추동맥 2예

서민지 · 임채문 · 박지강

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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