A Case Report of Variant Origin of Left Vertebral Artery from Aortic Arch and its Embryological Explanation

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ABSTRACT

Vertebral artery is the first branch of subclavian artery. It merges with the same artery of the opposite side to form basilar artery and becomes one of the important source of blood supply to the brain. Variation in the origin of left vertebral artery was found in 65 year old female during magnetic resonance angiography of the neck vessels. It originated from aortic arch and was longer as compared with the right vertebral artery. Its further course was as usual. Awareness of such variations is important in supra-aortic vascular surgery and is clinically significant during diagnostic procedures like angiographi.

1. Introduction

Vertebral artery normally originates from the superoposterior aspect of the first part of subclavian artery. It passes through the transverse foramen of all cervical vertebrae, except the seventh vertebra, curves medially behind the transverse process of the atlas and enters into the skull through foramen magnum. It merges with the same artery of the opposite side at the inferior edge of pons to form the basilar artery. Vertebral artery is one of the main arterial blood supplies for the brain. The segment of the artery from its origin to its entry into the transverse foramen is called prevertebral segment. The rest of the artery passes through the transverse foramina for better protection [1, 2]. Vertebral artery has several variations. Some of these variations are related to its abnormal origin and course and some other to its abnormal diameter [3-5]. Vertebral artery can arise from aortic arch, the common carotid artery, and internal or external carotid arteries.

In a study varied out by Komiyama et al. the frequency of left vertebral artery variations in the population of study was 2.4% [6]. Several studies have been performed on vertebral artery variations and according to these findings the estimated frequency of variations of this artery is between 1 and 3% [7].

2. Case Report

A 65-year-old female with headache and high blood pressure, was referred for Magnetic Resonance angiography (MRA) of the neck vessels. MRA was performed on a high field 3 Tesla MRI scanner (Siemens MAGNETOM Trio) using 3D Flash (Fl3D) sequence. The TE and TR parameters were determined 1 and 3 milliseconds, respectively.

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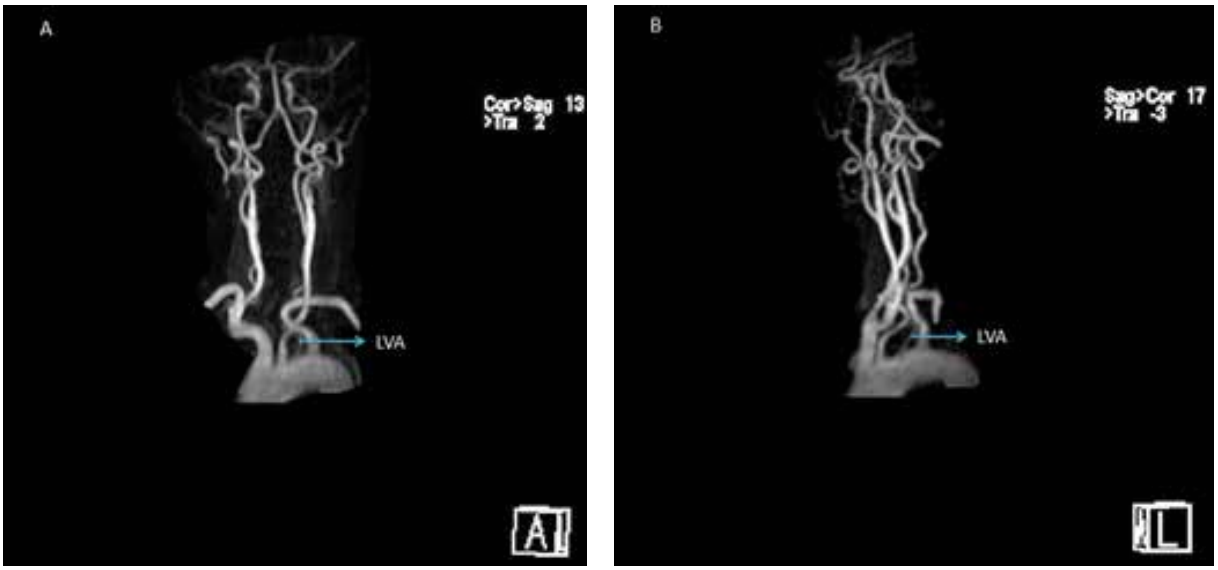

Figure 1. MR Angiography of neck showing the variation of left vertebral artery (LVA) originated from the aortic arch, displayed in anterior (A) and lateral(B) views.

For a better view of the neck vessels, 20 ml of gadolinium was administered. The contrast media was injected at the rate of 3ml/s, using MRI injection system. The Care bolus technique was used to control the contrast media administered into aortic arch. The raw data were processed using maximum intensity projection (MIP) algorithm, and the angiographic images were obtained.

In vivo studies of the neck arteries with MRA technique, variation of left vertebral artery was shown. Three-dimensional reconstruction of the images revealed that the right vertebral artery had a normal origin and course, but the left vertebral artery did not originated from the subclavian artery; instead, it branched from the aortic arch. As seen in Figure 1, the aortic arch had four branches in this patient, including: brachiocephalic trunk, left common carotid artery, left vertebral artery, and left subclavian artery from right to left.

After branching from the aortic arch and in its course, the left vertebral artery has entered into the transverse foramen of the sixth cervical vertebra and continued its normal

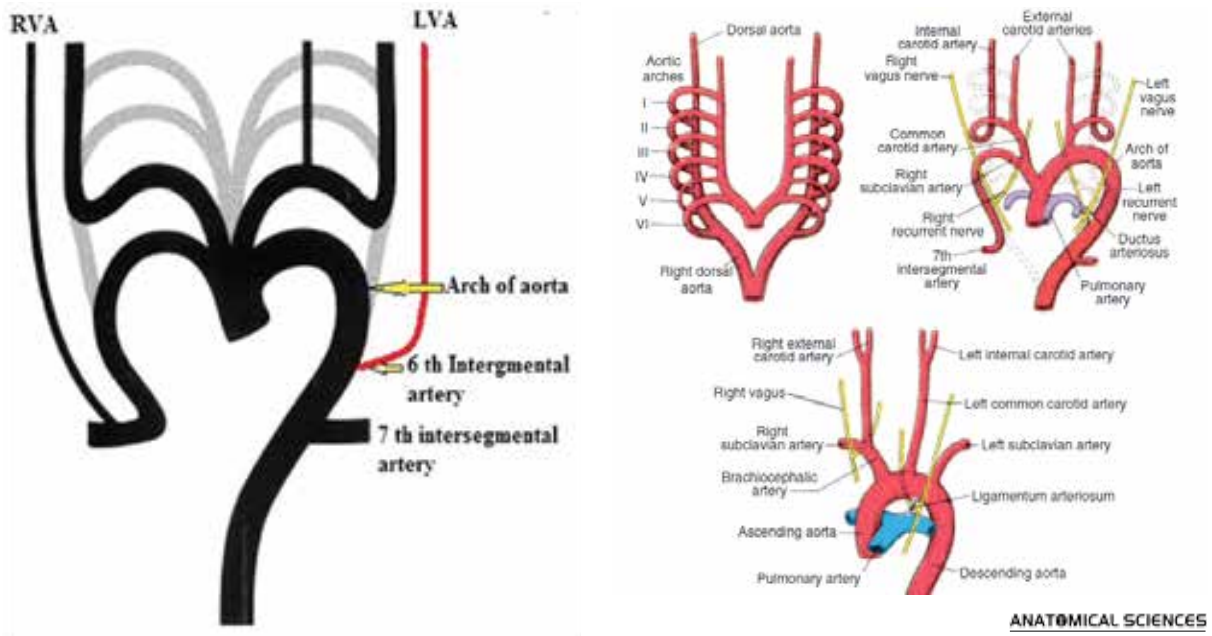

Figure 2. Right: Normal formation of embryonic vertebral artery. Left: Variation in left vertebral artery origin from aortic arch.

course. It should be noted that the right vertebral artery had a normal course and the two vertebral arteries merged in order to form the basilar artery. The diameters of right and left vertebral arteries at their origins were measured as 4.3 and 3.9 mm, respectively.

3. Results

The embryogenesis of the vertebral artery takes place between 32 and 40 days of development. During fetal period, all inter-segmental arteries, except the seventh inter-segmental artery which makes the first part of the subclavian artery, are destroyed. This part of the subclavian artery is the origin of vertebral artery [8]. The variation in the origin of left vertebral artery at aortic arch is due to remaining of the left sixth inter-segmental artery, which is responsible for creating the first part of the artery (Figure 2). In this variation, the left vertebral artery is located between the left common carotid artery and the left subclavian artery [9, 10]. When the left vertebral artery originates after the left subclavian artery, it is formed from the left eighth inter-segmental artery [11].

According to the studies carried out by Bernadi and Deton, variation of the vertebral artery origin can cause alteration in cerebral hemodynamics [12]. This kind of variation may be associated with retroesophageal right subclavian artery variation [13, 14]. In addition, atherosclerosis of the prevertebral segment of this artery has been reported in studies by Vicko et al. [15]. Therefore, evaluation of these changes may be useful in the clinical examinations in case of variation in left vertebral artery.

Since the vertebral artery is one of the main arterial blood supplies for the brain and its damage may result in serious complications, possible variations of the artery should be considered in the surgeries of the neck base and cervical vertebrae. We should also prevent from placing pressure or damaging the artery.

4. Discussion

Considering variations in the origin of vertebral artery from aortic arch is of particular importance in surgeries of the neck base and supra-aortic arteries. In addition, information on the abnormal origin of the artery prevents misdiagnoses during diagnostic procedures such as Doppler ultrasound [16]. Therefore, it is necessary to evaluate patients before surgeries of supra-aortic arteries and assess the neck base in terms of such variations.

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