Aberrant origin of the left vertebral artery: clinical case and scientific literature

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SUMMARY

The variants in the origin of the trunks of the aortic arch are very heterogeneous. Among them, it is worth highlighting the variants that involve the origin of the vertebral artery and more specifically the left vertebral artery. We present the case of a 62-year-old patient in whom an aberrant vertebral artery was incidentally described in a computed tomography for oncological evaluation. This anatomical variant is asymptomatic in up to 5% of cases and can give rise to clinical problems of a vascular nature.

Key words: Vertebral artery – Anatomical variant – Aberrant – Computed tomography

INTRODUCTION

The aortic arch is an important structure in the human cardiovascular system, responsible for supplying oxygen-rich blood to the upper extremities and head. Three branches emerge from the aortic arch: the brachiocephalic trunk, the left common carotid artery, and the left subclavian artery. Under normal conditions, the left vertebral artery emerges from the left subclavian artery medial to the thyrocervical trunk and supplies blood to the upper part of the spinal cord, brainstem, and cerebellum. It ascends through the transverse foramina of all but the seventh cervical vertebrae and enters the posterior cranial fossa through the foramen magnum (Frankel and Roselli, 2023; Min et al., 2023). However, this structure does not always present the same anatomy in all individuals. Anatomical variants of the aortic arch are relatively common and may have clinical implications in some cases.

Anatomical variants of the aortic arch refer to any deviation from the normal structure and placement of the main branches of the aorta. These variants may imply a variation in the number, size, position and origin of the branches (Nandi et al., 2022). The presence of anatomical variants of the aortic arch may have important clinical implications in some patients, as they may affect blood perfusion to the upper extremities, head, and body. In addition, these variants can affect the interpretation of radiological studies, since the variation in the position and origin of the branches can make these structures similar to other pathologies (Case et al., 2015; Meester et al., 2023). Vertebral arteries are among thosemain arteries that supply blood to the spinal cord and brain.

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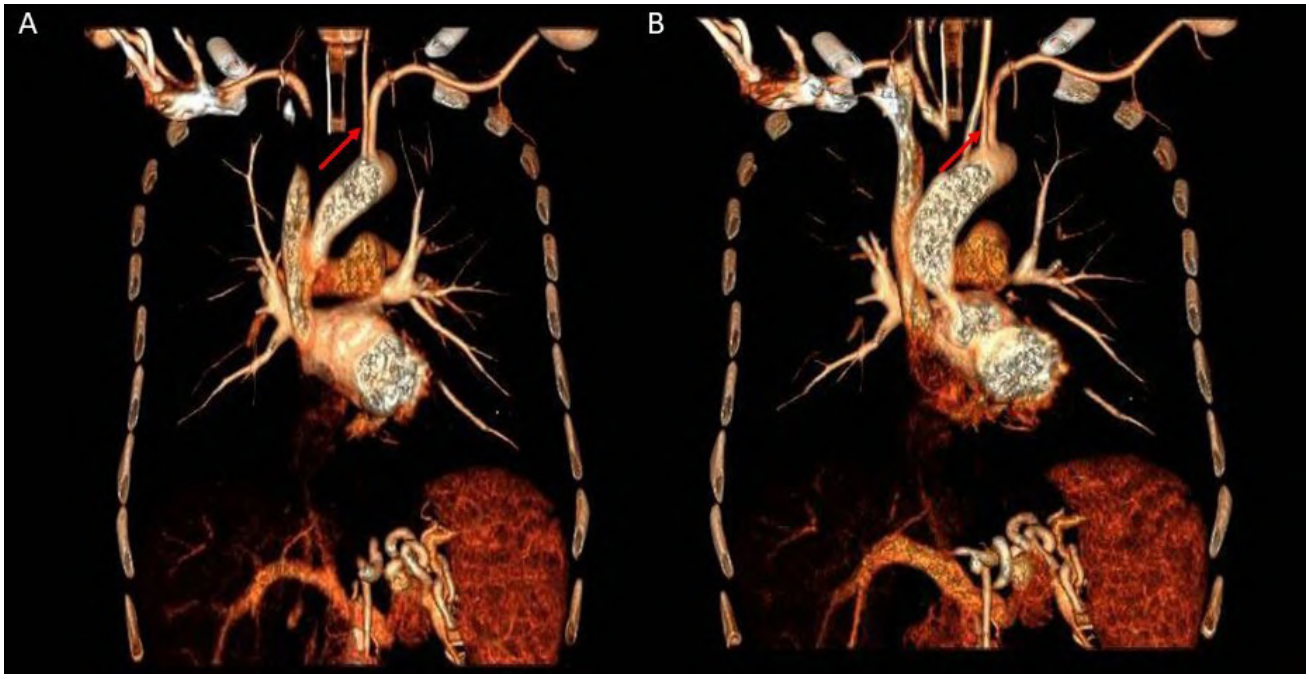

Fig. 1.- Coronal CT vascular reconstruction showing aberrant origin of left vertebral artery (red arrow) from aortic arc (**A** and **B**, different coronal views).

In terms of the embryological origin of the vertebral artery, cervical intersegmental arteries appear from the aortic arch. The first to sixth dorsal intersegmental arteries are anastomosed, and the inferior end is linked to the seventh dorsal intersegmental artery. The first portion of the left vertebral artery develops near the origin of the dorsal branch of the seventh cervical intersegmental artery. In order to go into the foramen transversarium of the sixth cervical vertebra, the artery follows a vertical and dorsal course (Magklara et al., 2020).

Normally, this artery arises from the left subclavian artery. However, in some cases, vertebral arteries may aberrantly originate directly from the aortic arch. One of the anatomical variants is known as aberrant origin of the left vertebral artery and is one of the most common variants of the aortic arch. More exactly, this aberrant origin comprises the types 3 and 4 of the classification of aortic arch trunks variants (Popieluszko et al., 2018). Although this anatomic variant may be asymptomatic in some patients, in others it may be associated with significant clinical complications.

CASE REPORT

This case concerns a 62-year-old male patient, a drinker and smoker, with no other personal history of interest. In 2017, the patient presented hoarseness and odynophagia, and an otorhinolaryngology examination was performed, which revealed a lesion in the left vocal cord that was pathologically diagnosed as squamous cell carcinoma of the larynx. In the CT corresponding to the extension study, an anatomical variant (Fig. 1) was observed by chance, consisting of the existence of an aberrant origin of the left vertebral artery directly from the aortic arch instead of originating from the left subclavian artery, which would be the usual origin. In fact, the left vertebral artery is originated from the aortic arch between the origin of the left carotid artery and the origin of the left subclavian artery. Furthermore, this arterial variant has a larger arterial diameter and penetrates through the transverse vertebral foramina, starting from the fifth cervical vertebra (Fig. 2). The patient had no symptoms in this regard. The final stage of his laryngeal tumor was T3N0M0. Due to the fact that the treatment with total laryngectomy would have been very mutilating, in this case a chemotherapy treatment based on cisplatin and radiotherapy for 2 months was decided. As of today, the patient is in complete response to treatment, that is, there is absence of any detectable cancer after completion of treatment and without signs of tumor relapse.

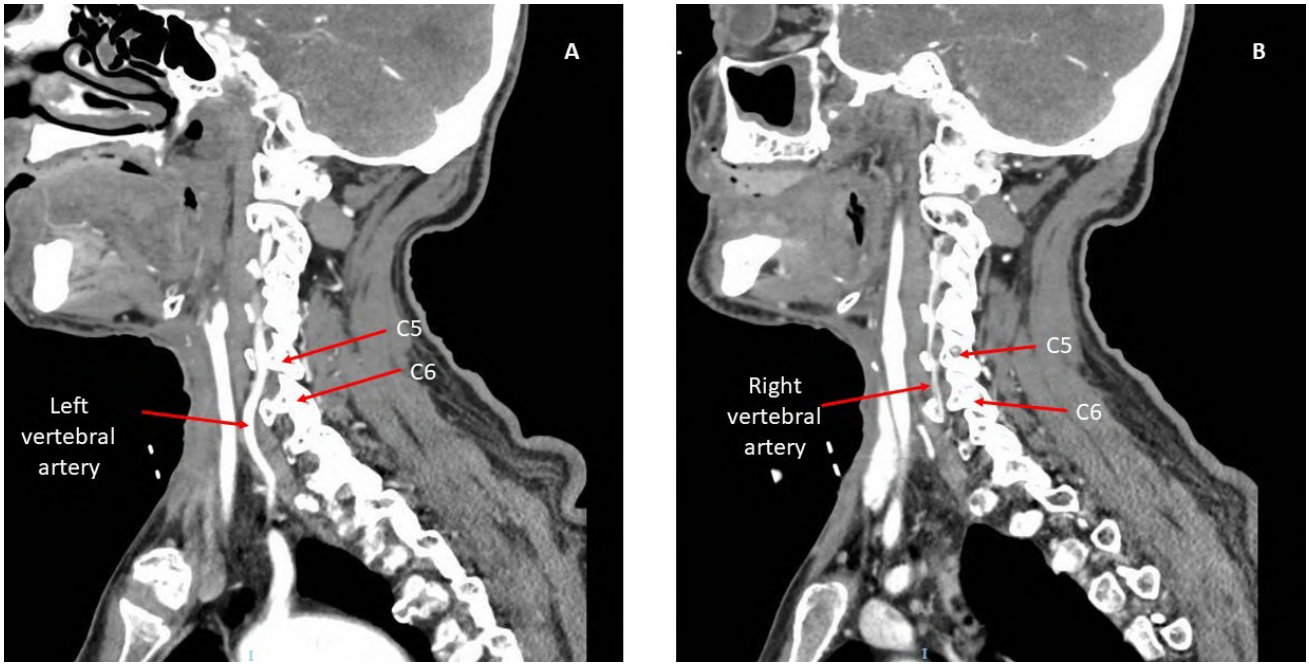

Fig. 2.- Sagittal CT with arterial intravenous contrast that show the entrance of left vertebral artery in transverse foramina in the fifth cervical vertebra (**A**) and in the sixth cervical vertebra in the case of right vertebral artery (**B**).

DISCUSSION

The existence of anatomical variations in the vertebral artery can be a problem when performing cervical surgeries on patients with degenerative diseases, tumors, infectious diseases or trauma, among others. In these procedures, an injury to the vertebral artery can be disastrous for the patient, since it can cause uncontrollable bleeding, syndromes associated with neck swelling such as dyspnea, and delayed hemorrhage from a pseudoaneurysm (Elnaggar et al., 2021). Regarding other studies that have described these malformations, it is worth highlighting the one published by Yuan et al., 2016, where it is indicated that most of the patients with alterations of the origin of the vertebral artery are asymptomatic and only 5.5% present some symptomatology derived from it.

According to different authors (Popieluszko et al., 2018; Adachi, 1928; Lippert et al., 1985; George et al., 2016), the variants of the origin of the aortic trunks are classified into 7 types. Of these, subtypes 3 and 4 are those in which the left vertebral artery originates directly from the aortic arch. Of them, subtype 3 would be the one that would correspond to the case described, since the rest of the aortic trunks originate in the usual way and the left vertebral artery would be the one that originates independently in the aortic arch before the origin of the left subclavian artery. Alterations in the origin of the left vertebral artery are present in 2.8% of the population, and subtype 3 is the third most common anomaly of the origin of the aortic trunks. Moreover, this case presents another variant, which consists of the left vertebral artery having a larger diameter than the right and penetrating the transverse foramina of the cervical vertebrae starting from the fifth vertebra. This anatomic variation is only present in approximately 3.3% of the population (Shin et al., 2014).

Finally, Ibrahim et al. (2021) describe the difficulty of aortic surgery in these patients, since they require different surgical strategies, and the risk of complications would be greater.

CONCLUSION

In conclusion, the aberrant origin of the left vertebral artery from the aortic arch is a rare anatomical variant that may be associated with various pathologies and complications. Their knowledge is important to avoid diagnostic errors and to plan safe surgical and radiological procedures.

ETHICAL CONSIDERATIONS

This clinical case has been carried out following the guidelines of the Virgen de las Nieves Hospital in Granada and the Helsinki protocol, with authorization for its publication being confirmed.

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