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Anatomical Anomaly: Case Report of the Absence of the Right Common Carotid Artery

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ABSTRACT

Purpose: *Aortic arch anatomical variations are of surgical importance. Many variations of the aortic arch and associated vessels may be found incidentally or post-mortem.*

Methods: *A 61-year-old presented with symptoms suspicious of a cerebrovascular accident.*

Results*: The patient was found to have the right internal and external carotid arteries emanating from the right subclavian artery in absence of a common carotid artery on computed tomography angiography of the neck.*

Conclusion: *A recent comprehensive review noted 41 published cases of common carotid artery aplasia with the right internal carotid originating from the subclavian artery in only 4 of these cases. The current case represents a rare absence of the right CCA with the right ICA and ECA originating separately from the right subclavian artery.*

Keywords

Carotid Arteries, Vascular Malformations, Angiography, Imaging, Three-Dimensional.

Abbreviations

Common Carotid Artery (CCA); External Carotid Artery (ECA); Internal Carotid Artery (ICA); Subclavian Artery (SA); Brachiocephalic Artery (BA).

Introduction

Abnormalities in the development of the embryologic aortic arches infrequently occur and lead to variations of the aortic arch and its branches [1]. In rare cases, the external and internal carotid arteries arise independently with complete absence of the common carotid [1. The absence of the common carotid artery entails the persistence of the ductus caroticus leading to the disappearance of the third arch vessel [2]. Previously, absence of the common carotid artery (CCA) showed no preference for side or gender and potentially occurred bilaterally [1,3]. More recent research still supports the notion that CCA aplasia is not significantly associated with left–right side preferences [4,5]; however, it does occur more commonly within the female gender [6].

In the absence of a right CCA, the right external carotid artery (ECA) originates from the brachiocephalic artery while the right internal carotid artery (ICA) arises from the right SA [7,8]. When the anomaly presents on the left, the ECA and ICA arise independently from the aortic arch, between the brachiocephalic trunk and the left subclavian artery (SA) [9,10]. Previous research states this anomaly typically presents asymptomatic unless

associated with various different conditions such as cervical aortic arch, double aortic arch, right-sided aortic arch with aberrant left SA, and persistent trigeminal artery [3]. One group of clinicians proposed that variations in the aortic arch development associated with absence of the CCA may result from simultaneous events during the early embryogenesis [11].

Case Report

A 61-year-old with past medical history of bilateral foot drop, and cerebrovascular accident 1 year prior without residual deficit presented to the emergency department with acute left upper and lower extremity weakness and paresthesias. Vital signs, electrocardiogram, chest X-ray, and computed tomography (CT) of the head were within normal limits. CT angiography of the neck revealed the right ECA and ICA arising from the right SA in absence of a CCA. No stenosis or occlusion were noted in the right ICA, right ECA, left CCA, left ICA, left ECA or vertebral arteries.

Reformatted images help display the respective courses and positioning of the independent ICA and ECA.

Discussion

The current case represents a rare absence of the right CCA with the right ICA and ECA originating separately from the right SA. A recent comprehensive review noted 41 published cases of common carotid artery aplasia with the right internal carotid originating from the SA in only 4 of these cases [2,6,12-14].

A systematic review conducted by Vasovic and associates revealed twenty-one different pathological states including amaurosis fugax, cerebral artery aneurysms, arteriovenous fistulas, and cerebral vascular accidents occurring as a result of CCA aplasia with aneurysms occurring in 13.69% of case and 17.80% of cases presented without pathology [6]. A recent review summarized 16 vascular variants with the most common being brachiocephalic trunk aplasia including separated right ECA and the right ICAs arising from either the right-sided cervical aortic arch (RCAA) or brachiocephalic trunk. Other vascular variants included the left ECA and ICA originating from the LCAA or RCAA, or the right ECA and ICA originating from the RCAA, or the left ECA and ICA originating from the Persistent Proatlantal Intersegmental Artery [6].

Six pairs of aortic arches form in the early embryonic stage. The third set of arches represent precursors to the carotid system while the fourth set develops asymmetrically. The left fourth arch remains continuous with the aortic arch sac and the left dorsal aorta, forming the left aortic arch. The right fourth arch, combined with part of the right dorsal aorta, develops into the brachiocephalic artery as well as the proximal right SA. The ductus caroticus, a region of the dorsal aortae between the third and fourth arches, typically regresses by the sixth week [15,16].

Migration of the ventral pharyngeal artery from the aortic sac to the third arch results in formation of the ECA [12]. Normally, the CCA develops from the root of the ventral aorta between the third and fourth arches. If the ductus caroticus fails to involute and the third arch regresses, the ECA and ICA arise from separate origins [17].

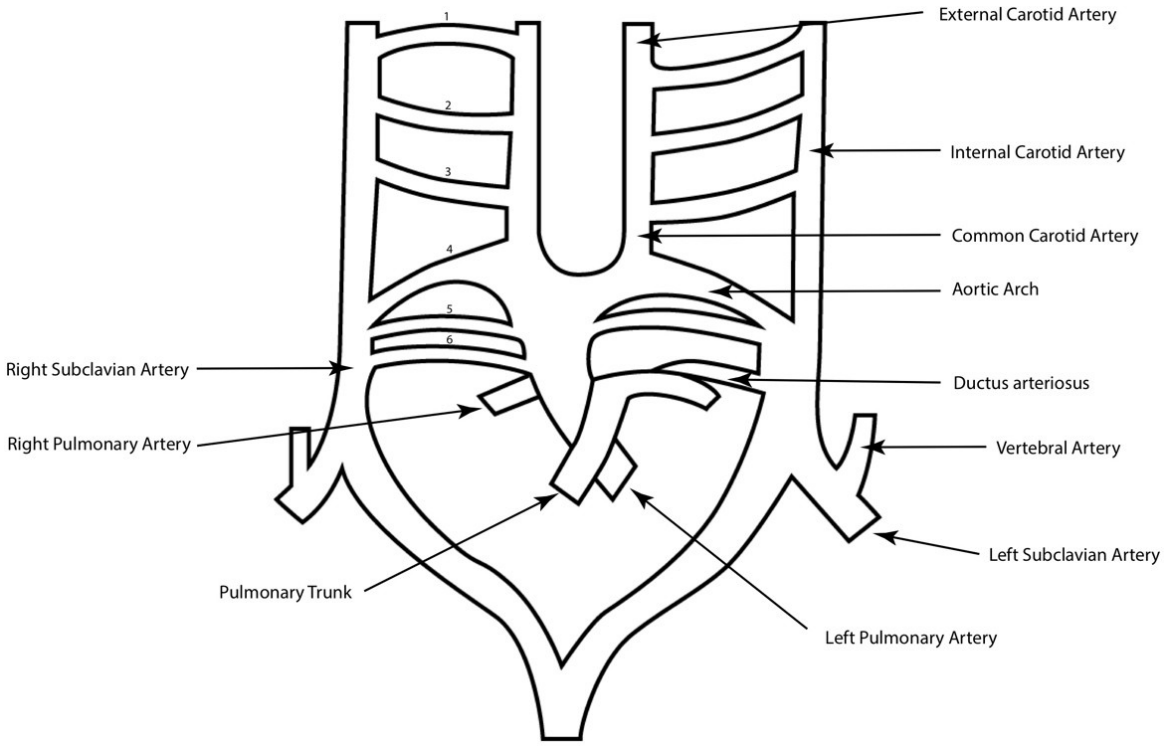

Figure 1: Embryological Representation of Aortic Arches and Derivatives.

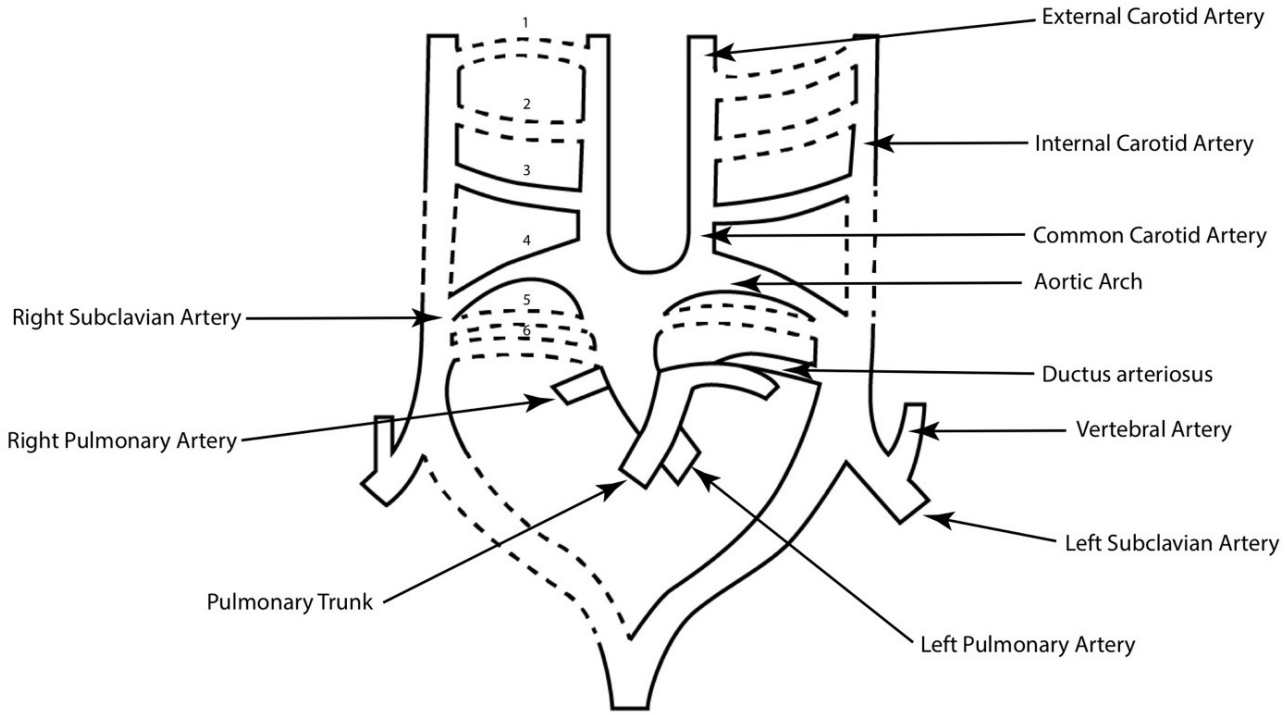

Figure 2: Normal Anatomical Representation of Aortic Arches and Derivatives. Note: The dashed lines represent obliterated embryological vascular structures.

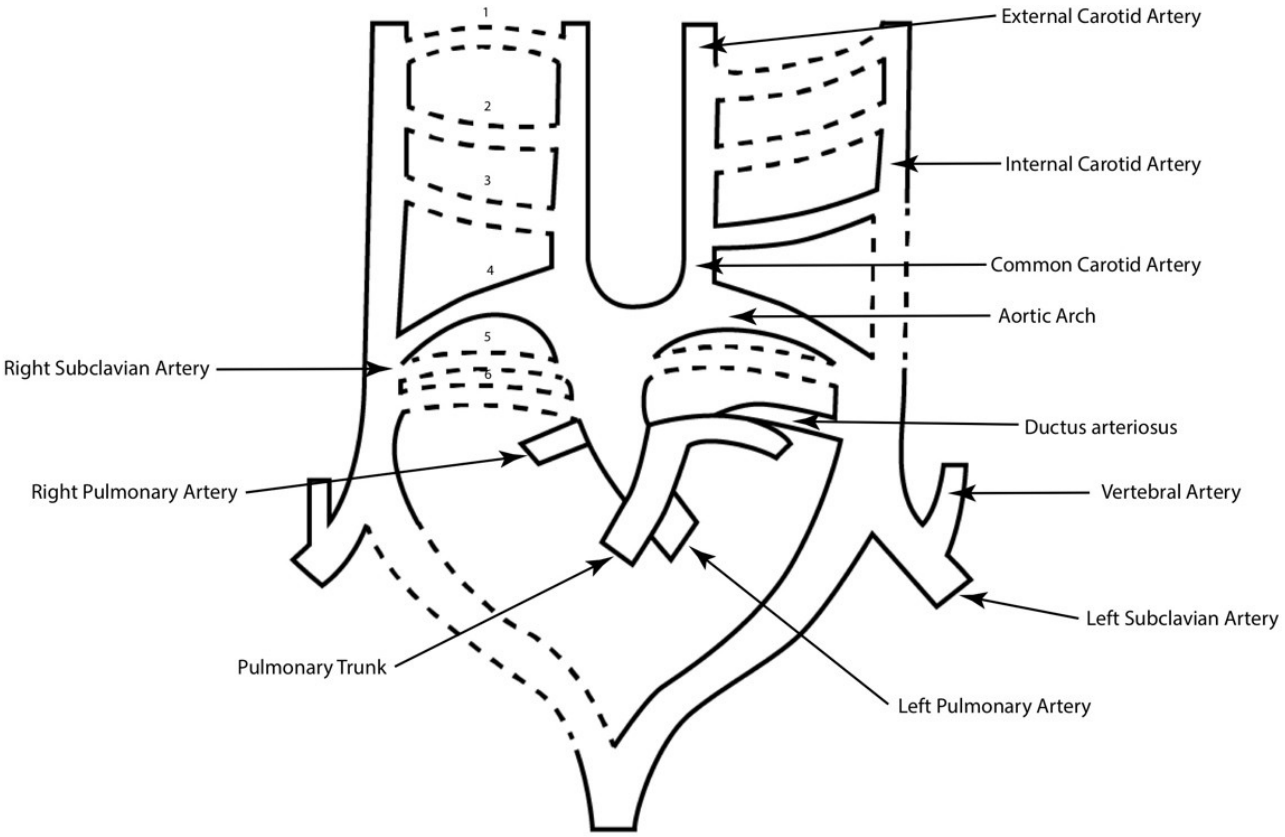

Figure 3: Patient Anatomical Representation of Absent Right Common Carotid Artery. Note: ECA and ICA arise separately from the SA.

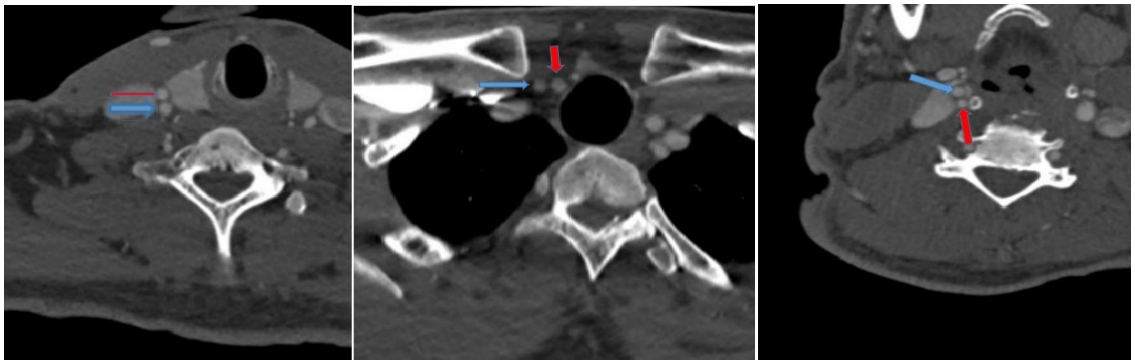

Figure 4: Selected axial, coronal and sagittal source images of neck CTA, from inferior to superior, show separate origins of the right internal carotid artery (ICA red arrow) and right external carotid artery (ECA blue arrow).

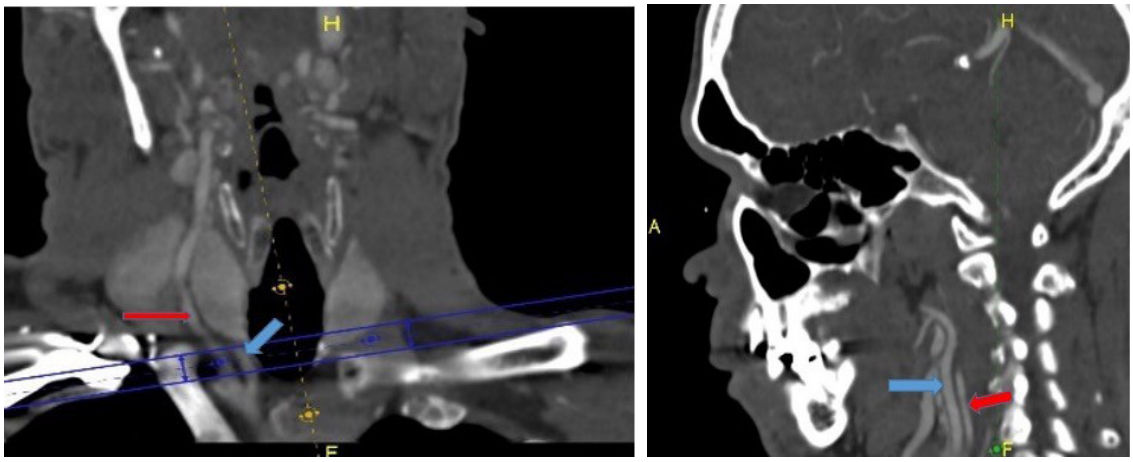

Figure 5: 3-D CTA reconstructions reveal the unique origins and routes of the right internal (red arrows) and external (blue arrows) carotid arteries.

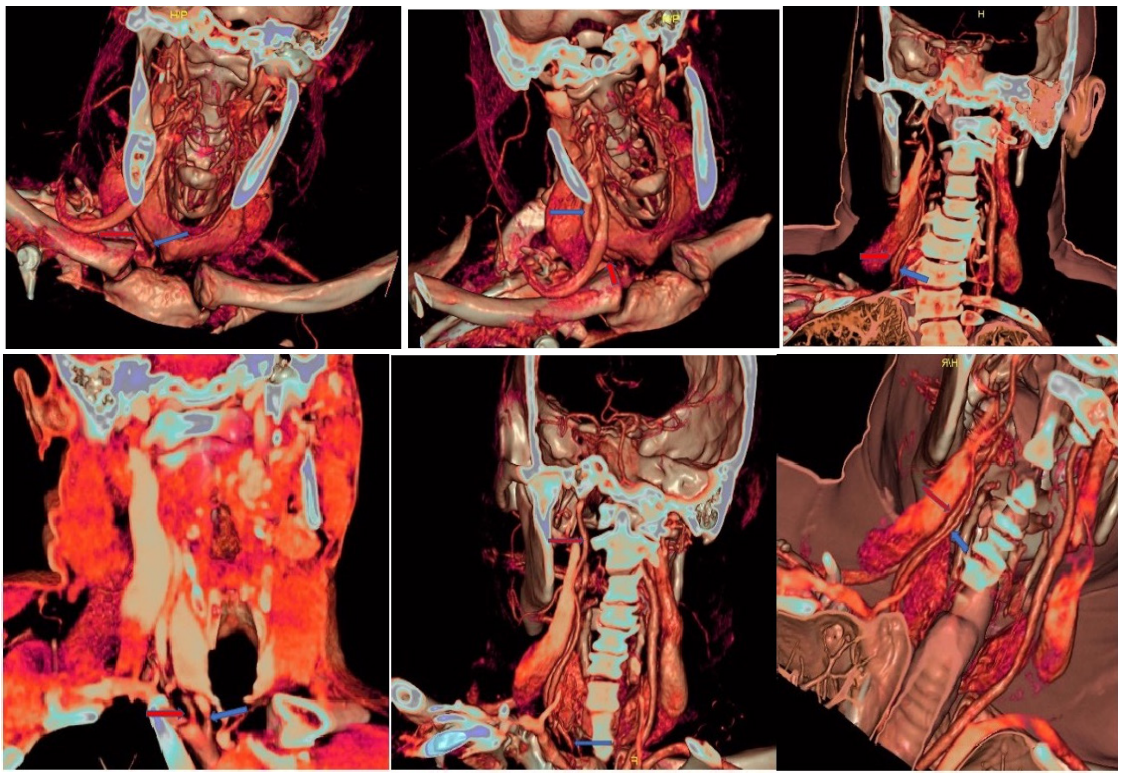

Figure 6: Schematic representation of separate origins of the right internal and external carotid arteries. The right common carotid artery is absent.

Additionally, if the fourth arch involutes and both the third arch and ductus caroticus persist, the CCA is again absent and associated with a cervical aortic arch [17]. Moreover, literature lacks a clear definition of when the brachiocephalic artery (BA) transitions into the SA. As a result, different anatomical variants regarding the origin of the ECA or ICA may exist based upon the Radiologist's interpretation of the imaging findings. Clinicians must create definite parameters which constitute landmarks which delineates the BA from the SA.

Conclusion

Absence of a common carotid artery is a rare vascular anomaly. Unlike most cases of absent common carotid arteries, in the current case, the right ICA and ECA arose directly from the right SA. As complications may arise in patients with cardiovascular-related comorbidities, clinicians should provide careful consideration to this anomaly when determining the risks and benefits of potential surgical interventions. Additionally, patients presenting with signs and symptoms of cerebrovascular insult warrant further investigation and follow-up particularly when associated with this abnormality in order to further expand the available literature.

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