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Internal Carotid Artery Agenesis: A Rare Incidental Finding

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Abstract **Case Report**

Internal carotid artery agenesis is a very rare anomaly, occurring during the early stages of embryonic development. We report the clinical presentation and imaging findings both on CT and MRI of the incidental finding of a left internal carotid agenesis in a 40 year old female. Magnetic resonance angiography was the most valuable diagnostic tool for the positive diagnosis, showing the absence of the left internal carotid artery, with left circulation arising from the right anterior cerebral artery and left posterior cerebral artery. Unenhanced computed tomography was used to differentiate between internal carotid agenesis and hypoplasia. Imaging should also look for associated malformations such as aneurysms as well as ischemic and hemorrhagic complications.

Keywords: Agenesis, Internal carotid artery, Congenital anomaly.

INTRODUCTION

Congenital agenesis of the internal carotid artery (ICA) is a very rare anomaly that occurs at an early stage during embryonic development, with several types of collateral pathways developing to compensate for the decreased cerebral blood flow [1].

Patients presenting with internal carotid artery agenesis are often asymptomatic due to this well-developed collateral circulation, but some may present with headache, seizures, or transient ischemic attacks [2].

ICA agenesis can be accompanied by various posterior circulation abnormalities including aneurysms, dolichoectatic vessels [3].

Computed tomography angiography (CT angiography), magnetic resonance angiography (MRA) are commonly used modalities to make the diagnosis. Unenhanced skull base computed tomography will show the absence of carotid canal, thus differentiating carotid agenesis from carotid hypoplasia [2].

We present the case of an incidental finding of left internal carotid artery agenesis.

CASE REPORT

We report the case of a 45 years old female, with no known pathological history, presenting with chronic headaches. There was no history of hypertension, diabetes, or any significant family history. Clinical examination showed no neurological deficit.

A Brain MRI was performed and demonstrated no parenchymal signal abnormalities or signs of cerebral infarction or hemorrhage. However, the 3D Time-of-flight (TOF) sequence showed an absence of the left internal carotid artery (Figure 1).

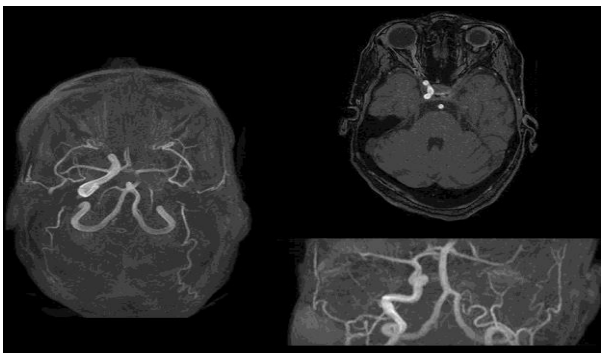

Figure 1: Absence of the left internal carotid artery on Time-of-flight (TOF) MRI

The left middle artery arises from the left posterior cerebral artery.

The right and left anterior cerebral arteries both arise from the right middle cerebral artery (Figure 2).

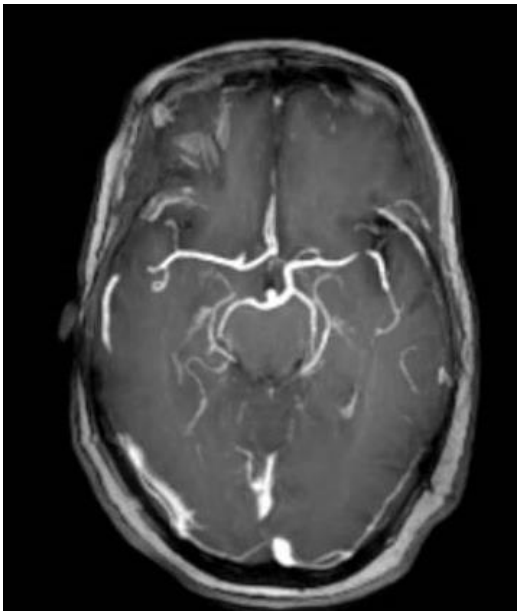

Figure 2: T1 EG with contrast enhancement showing the left middle cerebral artery rising from the posterior cerebral artery. The right and left anterior cerebral arteries both arise from the right middle cerebral artery

There were no signs of associated cerebral malformation or aneurysm.

A non-contrast head CT was then performed and the study in the bone window showed the absence of the left internal carotid canal (Figure 3).

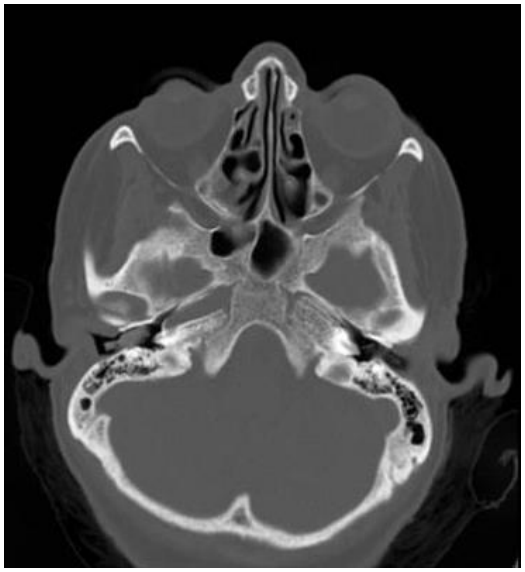

Figure 3: Absence of the left internal carotid canal on non-contrast head CT in the bone window

Based on these findings we categorized this anomaly as a left internal carotid agenesis, rather than hypoplasia.

DISCUSSION

The ICA begins to develop from the first and third aortic arches and the paired dorsal aorta.

The ICA begins to form on the 24th day of embryogenesis, in the 3mm stage of embryological development, rising from the third aortic arc, and it will be completed by the 6th week of embryonic life [2, 4].

The cephalic portion of the dorsal aorta then joins the distal extremity of the third aortic arch and forms the distal part of the ICA.

The carotid canal formation occurs at the same time and is dependent on the development of the ICA. The failure of the third distal aortic arch to develop, or its incomplete development, results in agenesis or hypoplasia of the ICA respectively.

Therefore, the congenital absence of the artery is accompanied by the absence of the carotid canal [3–7].

Carotid agenesis can be both unilateral and bilateral. There is a predilection to left sided carotid agenesis, with a reported ratio of 3:1. Most cases are clinically silent, due to well-developed collateral circulation, and are therefore found incidentally [2, 3].

In some cases, patients present with subarachnoid hemorrhage, secondary to rupture of cerebral aneurysm, as there is a significantly higher association of aneurysms in these patients [5].

Other abnormalities associated with carotid artery agenesis include dolichoectatic arteries [8], aplasia of vertebral artery or basilar artery with rete formation [3, 9, 10].

CONCLUSION

ICA agenesis is a rare and often asymptomatic finding, It is however important to recognize this condition due to its association with hemodynamic changes and other vascular malformations and their potential risks such as hemorrhage or ischemia.

Competing Interests: None
Patient Consent: Written and informed consent for publication of the case was obtained from the patient.

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