Case Report

HEALTH SCIENCES
MEDICINE

DOI: 10.32322/jhsm.1196350
J Health Sci Med 2023; 6(1): 220-222

Persistent trigeminal artery incidentally found in a patient with brain posterior system infarction: a rare case report

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Cite this article as: Aytaç A, Yilmazsoy Y. Persistent trigeminal artery incidentally found in a patient with brain posterior system infarction: a rare case report. J Health Sci Med 2023; 6(1): 220-222.

ABSTRACT

The persistent trigeminal artery (PTA) is a persistent, primitive, embryonic anastomosis that provides the blood flow between the vertebro-basilar system and the carotid system. The presence of PTA anastomosis may create an advantage by providing collateral circulation during a stroke as in cases of leptomeningeal collaterals, external-internal carotid artery anastomoses, and the polygon of Willis. However, patients with this variation are more susceptible to the development of non-occlusive posterior arterial system infarction when they experience hypotension attacks. In the literature, there are only few case reports on non-occlusive posterior system infarction associated with PTA variation. In this case report, we present to an 81-year-old patient with posterior system infarct findings and persistent trigeminal artery variation.

Keywords: Persistent trigeminal artery, posterior arterial system infarction, hypotension

INTRODUCTION

Carotid-vertebrobasilar anastomoses, which provide blood supply to the vertebrobasilar system from the internal carotid artery (ICA) in the embryonic period, are called presegmental arteries. Presegmental arteries that are present in the embryonic period disappear by involution during the intrauterine period, but if there is a problem during this process, they do not show regression and can still be seen in the adult period (1). The most common presegmental arteries in adulthood are the persistent trigeminal artery (PTA), persistent hypoglossal artery, persistent otic artery, and persistent proatlantal intersegmental artery (1). PTA accounts for approximately 85% of all persistent presegmental arteries (2). In digital subtraction angiography (DSA), PTA is observed at a rate ranging from 1 in a 1,000 to 6 in 1,000, and it is usually unilateral (2, 3). In radiological examinations, almost all cases are detected incidentally. Therefore, the number of actual cases is considered to be above this rate (2). The PTA variation was angiographically classified by Saltzman (3) and Wollschlaeger (4). In Saltzman type 1, PTA opens to the distal of vertebral artery. The posterior communicating artery (PCOM) and the distal end of the basilar artery are absent, or the vertebral and basilar arteries are hypoplastic. In Saltzman type 2, PTA supplies the superior cerebellar arteries (SCAs) through the posterior cerebral arteries (PCA) supplied by PCOM. In Saltzman type 3 (rare), PTA supplies bilateral SCA and contralateral PCA (4).

PTA is mostly asymptomatic. However, in the literature, pathological conditions, such as aneurysms, vascular-nerve compression, trigeminal cavernous fistulas, and thromboembolic ischemia, as well as associated neurological conditions, palsies of the third sixth cranial nerves, trigeminal neuralgia, vertigo, ataxia, migraine, and headache have been described in patients with this variation (2,4). In this report, we present a case of PTA variation with multiple foci of infarction in the posterior arterial system irrigation area and no arterial occlusion.

CASE REPORT

An 81-year-old female patient presented to the emergency department in April 2022 with the complaints of sudden onset of dizziness, visual impairment, imbalance, and ataxia. She stated that she had previously experienced these symptoms occasionally. There was no exacerbation of symptoms with head rotation. According to her anamnesis, she had a history of surgery due to aortic valve stenosis but no previous history of loss of consciousness or seizures. She also stated that she occasionally had attacks of a sudden drop in blood pressure. There was no suspicion of recent toxin exposure or medication use. No significant neurological deficit was detected in the physical examination.

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Received: 29.10.2021 **Accepted:** 22.12.2022

During the follow-up of the patient in the emergency department, millimetric foci showing diffusion restriction consistent with acute infarction were observed in the left cerebellar hemisphere, left occipital lobe, and both thalami in the diffusion-weighted magnetic resonance imaging examination performed as the initial imaging method (**Figure 1a, 1b, 1c**).

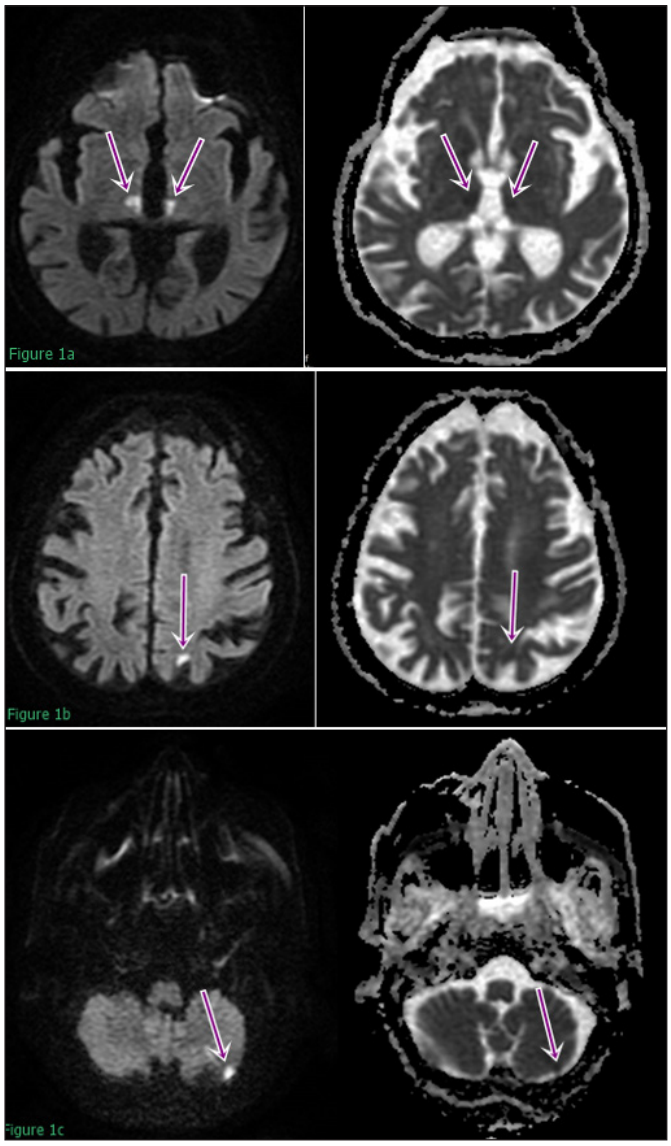

Figure 1: Diffusion-weighted magnetic resonance images showing millimetric foci showing diffusion restriction consistent with acute infarction in a) both thalami, b) left occipital lobe, and c) left cerebellar hemisphere

The patient was followed up in the neurology service with the diagnosis of stroke. During this period, brain magnetic resonance angiography was performed and showed hypoplasia in the distal parts of both vertebral arteries and proximal part of the basilar artery. In addition, it was observed that the basilar artery was filled by a collateral artery originating from the right ICA (**Figure 2a, 2b**).

In the subsequent diagnostic DSA examination, there was no contrast filling in the basilar artery after the right and left vertebral artery injection. However, after the right common carotid artery injection, a collateral artery consistent with PTA was observed to originate from the right ICA and fill the basilar artery (**Figure 3a, 3b, 3c, 3d**).

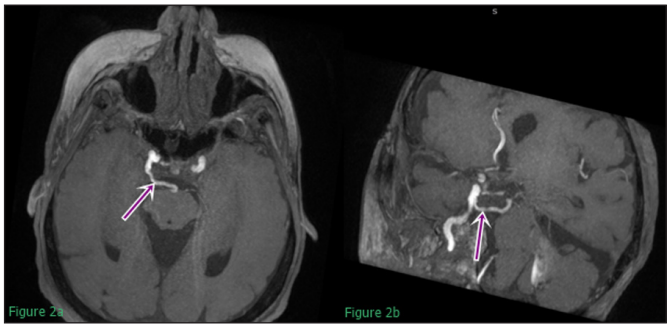

Figure 2: Magnetic resonance angiography images showing the hypoplasia of the distal of both vertebral arteries and proximal of the basilar artery. The distal of the basilar artery is filled by the collateral artery originating from the right internal carotid artery. Arrows in a and b indicate the collateral artery.

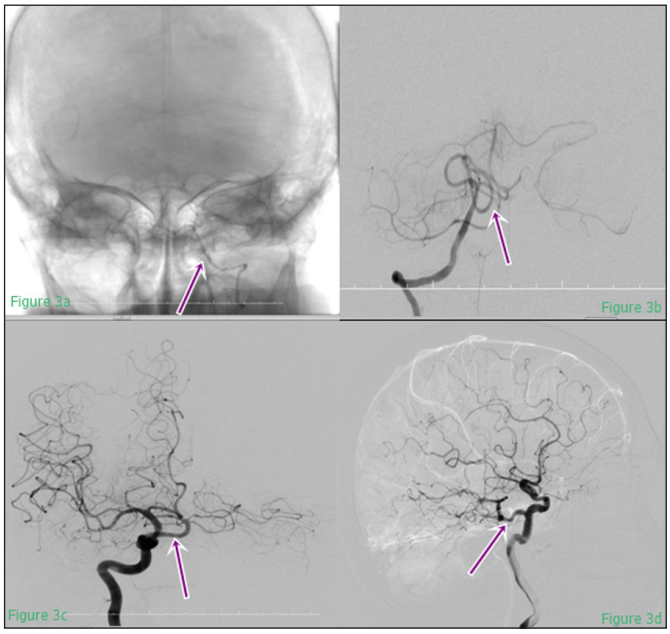

Figure 3: Diagnostic digital subtraction angiography images of the patient: a) There is no contrast filling in the basilar artery after both vertebral artery injections. The left vertebral artery is hypoplastic (arrow). b) The right vertebral artery ends in the posterior inferior cerebellar artery (arrow), with no contrast filling. c) and d) There is a collateral artery (arrow) originating from the right internal carotid artery after the right common carotid artery injection, which fills the basilar artery and is consistent with the persistent trigeminal artery. The posterior system shows contrast filling from the anterior system via the persistent trigeminal artery.

The patient was monitored with the use of anticoagulants in the neurology ward. The patient's vitals were observed to be stable during this period. She was discharged with clinical recovery after one week of follow-up.

DISCUSSION

PTA is the most common variation of the four well-known embryological primitive anastomoses between the carotid and vertebrobasilar systems and can be accompanied by vascular pathologies, such as stenosis,

occlusion, and dissection and vascular variations, such as the congenital absence of ICA (2,5,6). In addition, this variation may be a cause of vertebrobasilar insufficiency (2). Considering the conditions accompanying this variation and associated pathologies, there may also be a relationship between the presence of PTA and the formation and volume of infarction (5).

In non-occlusive ischemic strokes, the effect of collateral circulation on brain perfusion has been rarely reported in the literature. According to Da-Ping et al. (5), it is unclear whether PTA is associated with ischemic cerebrovascular disease. However, Ferreira et al. (3) reported that patients with PTA and basilar hypoplasia had hypoperfusion in the posterior fossa, and therefore were more susceptible to ischemic events. Engelhardt et al. (4) stated that as the number of collaterals increased, infarction became smaller.

In patients with the PTA variation, the steal phenomenon may occur in case of anterior system stenosis, which can cause vertebrobasilar insufficiency and lead to hemodynamic posterior system infarction. In some cases, the PTA variation can also be an advantage. For example, in case of basilar artery occlusion before the PTA entry point, PTA may have a preventive effect on the development of infarction by providing blood flow to the distal basilar artery (3).

In our patient, there was a Saltzman type 1 PTA variation, in which the posterior system irrigation area was supplied blood from the anterior arterial system via PTA. The patient had conventional imaging findings indicating posterior arterial system infarction, and clinical signs were consistent with the ischemic lesions of the cerebellar hemisphere and occipital cortex. Given the absence of large vessel occlusion and presence of a history of surgery due to aortic valve stenosis, it was considered that the infarct areas had developed in the posterior arterial system irrigation area secondary to hypoperfusion caused by a hypotension attack.

CONCLUSION

A PTA anastomosis is a rare variation. The presence of PTA anastomosis may create an advantage by providing collateral circulation during a stroke as in cases of leptomeningeal collaterals, external-internal carotid artery anastomoses, and the polygon of Willis. However, patients with this variation are more susceptible to the development of non-occlusive posterior arterial system infarction when they experience hypotension attacks..

ETHICAL DECLARATIONS

Ethics Committee Approval: Institutional approval was obtained for the use of the images.

Informed Consent: Written consent was obtained from the patient participating in this study.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version.

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