



Case Report

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Endovascular treatment of basilar artery aneurysm via the persistent trigeminal artery: A case report

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ABSTRACT

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An 85-year-old woman presented to emergency department of our hospital with a sudden onset headache and temporary loss of consciousness. Brain CT scan revealed subarachnoid hemorrhage (SAH) located in the left ambient and quadrigeminal cisterns. Brain CT angiography revealed a narrowed-necked aneurysm measuring 3.5x4.5x5 mm detected at the junction of the basilar artery (BA) and the left superior cerebellar artery (SCA). Both of the vertebral arteries were hypoplastic, and also proximal half of the BA was absent. Distal half of it was associated with a persistent trigeminal artery (PTA) located on the right side. The aneurysm of the basilar artery which could not be reached via the vertebral artery was embolized with detachable coils using primitive trigeminal artery. The cases with PTA are often discovered incidentally on imaging. Symptomatic cases often present with the signs of vertebrobasilar ischemia, cranial nerve palsy or rupture of the concomitant aneurysm. A BA aneurysm associated with PTA is very rare. Our case is also the second case treated endovascularly via the PTA.

Keywords:

Aneurysm
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Persistant trigeminal artery
Subarachnoid hemorrhage

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1. Introduction

In an embryo, there are transitory vessels those connect the developing carotid arteries and the precursor of the basilar artery (BA). These vessels regress during embryogenesis, most commonly. However, a very small portion of them may persist, so-called persistent carotid-vertebrobasilar anastomoses (PCVBA) (Aguilar et al., 2011; Takigawa et al., 2014). They may be associated with several cerebral vascular pathologies, such as vertebral artery hypoplasia, cerebral aneurysm and arteriovenous malformation (Ikushima et al., 2002; Takigawa et al., 2014). In such cases, aneurysms are

usually localized to the Willis polygon or the persistent trigeminal artery (PTA), the most common PCVBA. In this regard, accompanying posterior circulation aneurysms are very rare. In this case report, our aim is to present a patient with a ruptured BA aneurysm accompanied by a PTA, and to describe endovascular treatment of her.

2. Case

An 85-year-old woman presented to emergency department of our hospital with a sudden onset headache and temporary loss of consciousness. Non-contrast-

enhanced CT of the brain revealed subarachnoid hemorrhage (SAH), which was more prominent in the left ambient and quadrigeminal cisterns. On CT angiography of the brain, a narrowed-necked aneurysm measuring 3.5x4.5x5 mm was detected at the junction of the BA and the left superior cerebellar artery (SCA). Both of the vertebral arteries were hypoplastic, and also proximal half of the BA was absent. Distal half of it was associated with a PTA located on the right side. The patient was consulted with us by the referring neurosurgeon, and endovascular approach was found to be favourable for the treatment.

The patient was admitted to the angiography suite 2 days after the bleeding. Under general anesthesia, a 6-Fr long introducer sheath was inserted into her right common carotid artery by the femoral access route, and then a 5-Fr guiding catheter (Navien, Covidien, California, USA) was inserted prior to the orifice of the PTA via the right internal carotid artery. Subsequently, a 2.1 Fr microcatheter (Echelon 10, Covidien, California, USA) was introduced into the aneurysm sac via the PTA. The aneurysm sac was completely embolized by using multiple detachable coils (MicroVention, Aliso Viejo, CA) (Fig. 1). The procedure ended without any complications.

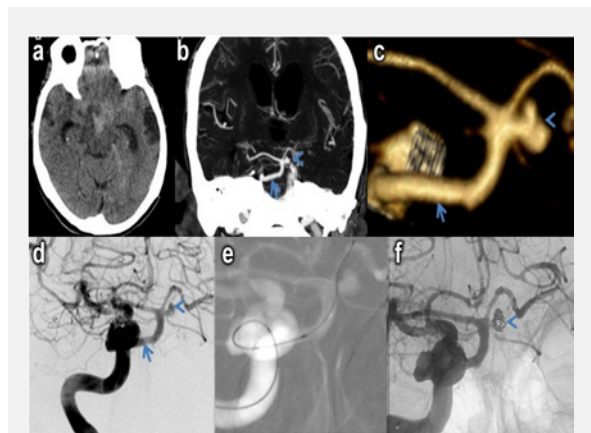


Fig. 1. Brain CT scan shows subarachnoid hemorrhage located in the left ambient and quadrigeminal cisterns (a). Brain CT angiography (b,c) and digital subtraction angiography (d) show the persistent primitive trigeminal artery (arrow) originating from the right internal carotid artery, displastic basilar artery and 3,5x4,5x5 mm saccular aneurysm (arrowhead) at the junction of the basilar artery-the left superior cerebellar artery. Final angiograms shows catheterization of the aneurysm through PTA and complete occlusion of the aneurysm after coils placement (e,f).

3. Discussion

In an adult, except for the posterior communicating artery (PCoMA), an anastomosis between the anterior and the posterior circulation reflects the persistence

of the embryonic arteries which could not regress due to anomalous embryological development of the posterior circulation. Such an anastomosis, so-called PCVBA, may be formed by four different arteries, and are as follows: persistent trigeminal artery, persistent otic (acoustic) artery, persistent hypoglossal artery and persistent proatlantal artery, in craniocaudal order. The arteries are named, with the exception of the last one, using the cranial nerves with which they run (Padget, 1948). Among these, PTA is the most common one with an incidence ranging from 0.1 to 0.6 percent (Aguilar et al., 2011; Takigawa et al., 2014). In the cases with PTA, ipsilateral PCoMA, ipsilateral vertebral artery or the BA are usually aplastic or hypoplastic (Ali et al., 2008; Aguilar et al., 2011; Azab et al., 2012).

Persistent trigeminal artery was described by Padget, however, the classification system developed by Saltzman is being used today (Padget, 1948; Saltzman, 1959). Saltzman defined three types of PTA according to the localization of the anastomosis and the presence of the PCoMA. In type 1 PTA, it joins the BA between the origins of the anterior inferior cerebellar artery (AICA) and the SCA. In this case, the section of the BA proximal to the anastomosis is hypoplastic, and the SCA and the posterior cerebral artery (PCA) is fed by PTA. In type 2 PTA, it joins the BA at the level of the SCA orifice, and the BA is absent below this point. The PCA is fed by the ipsilateral PCoMA. In type 3 PTA, we come across with a combination of the type 1 and 2, so-called PTA variant. In this type, PTA does not directly join the BA but establishes a connection with the SCA, the AICA or the posterior inferior cerebellar artery (Ali et al., 2008; Azab et al., 2012; Hwang and Kim, 2016). In type 3 PTA, the PCoMA is patent (Siqueira et al., 1993). In our case, the PTA joined middle third of the BA, and the section of the BA proximal to the anastomosis was agenetic. On both sides, any PCoMA was not present. The posterior cerebral circulation was supplied by the PTA via the right internal carotid artery. Our case was found to be compatible with the Saltzman type 1.

The cases with PTA are often discovered incidentally on imaging done for non-related causes, as the patients are frequently asymptomatic (Cloft et al., 1999). Symptomatic cases often present with the signs of vertebrobasilar ischemia, cranial nerve palsy or rupture of the concomitant aneurysm with the latter being the most common type of presentation (Ali et al., 2008; Pleş et al., 2015). The incidence rate of aneurysms associated with PTA is reported to be up to 14%. It is thought that altered flow dynamics due to aplasia or hypoplasia of the vertebrobasilar arteries trigger aneurysm formation. In such cases, aneurysms are most commonly localized to the arteries of the Willis polygon. Only 1% of these aneurysms are localized to the trigeminal artery itself (Tubbs et al., 2011). A BA

aneurysm associated with PTA is very rare, and, as far as we know, this is the second case where there is such a co-existence (Hanabusa et al., 2000; Kim et al., 2010; Aguilar et al., 2011).

Because of the difficulty accessing the aneurysm and the proximity to the brain stem, endovascular approach is the preferred mode of therapy in posterior system aneurysms. In evaluating the mode of endovascular treatment, the access route is decisive. In our case, the only access route to catheterize the aneurysm sac was the PTA itself because the BA section proximal to the anastomosis was aplastic. In the management of the

aneurysm, primary coil embolization was preferred, since the aneurysm was narrow-necked. Ikushima et al. (2002) presented a case treated with coil embolization in whom there was an aneurysm at the same location like our case, in 2002. Our case is also the second case treated endovascularly via the PTA.

In conclusion, aneurysms associated with PTA can be localized to the BA itself, and these aneurysms can be successfully treated with endovascular method via the PTA. To know the possible variations of the PTA is crucial in determining the endovascular treatment strategy.

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