Endovascular Treatment of Ruptured Aneurysm Associated with Vertebrobasilar Junction Fenestration: Case Report

Vertebrobaziler Bileşke Fenestrasyonuyla Birlikte Olan Rüptüre Anevrizmanın Endovasküler Yolla Tedavisi

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ABSTRACT Vertebrobasilar junction fenestration is a rare congenital anomaly which is commonly seen with an aneurysm formation. Because of the complex anatomical structure of this area complicates the surgical intervention, endovascular coil treatment of aneurysm is an alternative method. Several fenestration-related aneurysms may not be detected by 2D conventional angiography imaging due to their considerably thin and short structure or small size. By 3D rotational digital subtraction angiography, small-sized fenestrations can be examined at the intended plane from various angles. This method enables us to plan the endovascular intervention in detail by revealing orientation, neck, origin of perforator arteries, and the relation between aneurysm and fenestration. In the present case, we present the angiographic results of the case with vertebrobasilar junction fenestration, along with endovascular treatment of the ruptured aneurysm.

Key Words: Basilar artery; aneurysm

ÖZET Vertebrobasilar bileşke fenestrasyonu nadir bir konjenital anomalidir ve anevrizma formasyonuyla birlikte sıktır. Bu bölgenin kompleks anatomisi nedeniyle cerrahi müdahale zor olduğundan, anevrizmanın endovasküler coil tedavisi alternatif bir metoddur. Bazı fenestrasyonların çok ince ve kısa olması ve bazı anevrizmaların küçük olması nedeniyle iki boyutlu konvansiyonel anjiografi görüntülerinde saptanamayabilir. 3D rotasyonel dijital subtraksiyon angiografi ile küçük boyutlardaki fenestrasyonların ve anevrizmaların istenilen düzlemde, değişik açılarda incelenebilmesi mümkün olmaktadır. Anevrizmanın oryantasyonu, boynu, perforan arterlerin orjini ve anevrizma ile fenestrasyon ilişkisi gösterilerek endovasküler girişimin planmasına olanak sağlar. Biz bu yazıda vertebrobaziler bileşke fenestrasyonlu olgunun anjiografik bulguları ve rüptüre olmuş anevrizmanın endovasküler tedavisini sunmaktayız.

Anahtar Kelimeler: Basiler arter; anevrizma

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Saccular aneurysms of vertebrobasilar junction are not common. They are often associated with a basilar artery fenestration. Basilar artery develops in the 5th week of the fetal life as a result of the fusion of bilateral longitudinal neural arteries. When the regression of the temporarily bridging connection between longitudinal neural arteries during fusion process fails, fenestration develops. While fenestrated arteries have focal wall defects, aneurysm may develop from areas with a focal defect. Because of the complex anatomical structure of this region makes surgical intervention difficult, endovascular coil treatment is a significant alternative method for these types of aneurysms.[1,2] In the present case, we present the 3D rotational angiography results of the vertebrobasilar fenestration aneurysm and its treatment with endovascular approach.

CASE REPORT

A 43-year-old male patient presented to the emergency unit with a severe headache. He was conscious, cooperative, and his Glasgow coma scale value was 15. His medical history was unremarkable. The cranial computerized tomography (CT) examination showed diffuse subarachnoid hemorrhage in the posterior fossa cisterns. On reconstruction images of the 3-D subtraction angiography examination, a fenestration was determined in the proximal portion of the basilar artery. An aneurysm with 5x7 mm size, 4 mm neck, and a dome pointing anterior, was also present in the right loop of the fenestrated artery (Figure 1). The remaining intracranial arterial vascular structures were normal. Since surgical approach was a difficult treatment option due to its close localization to lower cranial nerves and many small perforator arteries, endovascular coil embolization was considered. The patient gave an infor-

a b c

FIGURE 1: In the 2D DSA image (A), fenestration at vertebrobasilar junction and a saccular aneurysm originating from the lower crus and showing a size of 5x7mm, is seen. In the 3D image (C), aneurysm can be seen in the inferoanterior portion different angle of the fenestration.

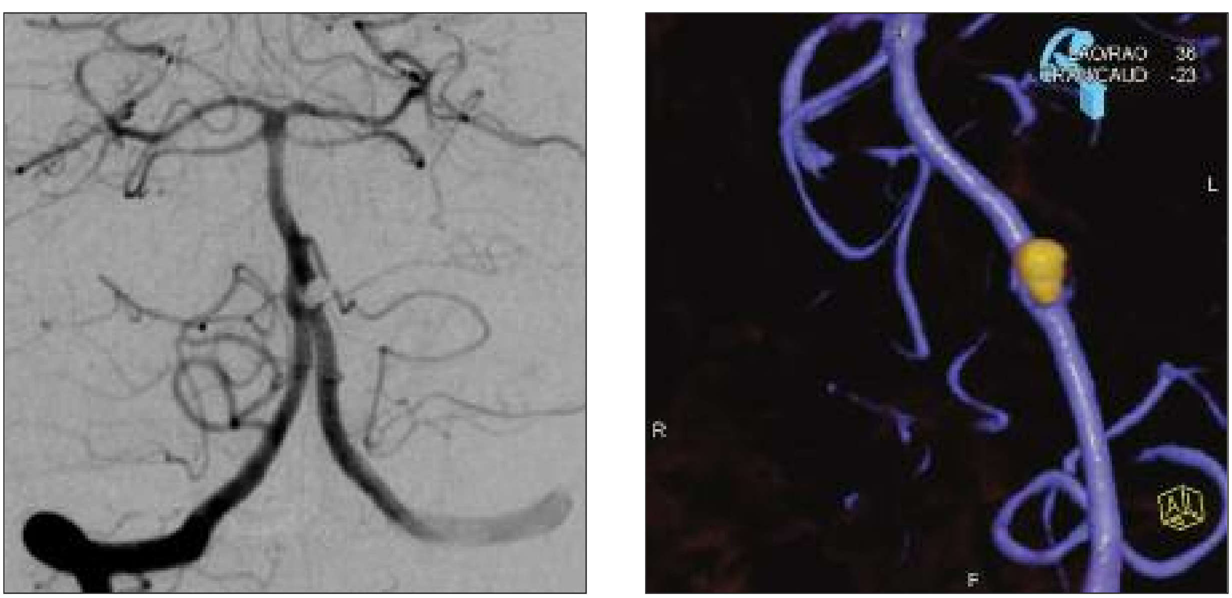

FIGURE 2: In the 2D DSA image (A), interior of the aneurysm full of coils after the post-embolization, is shown. No filling of aneurysm has been determined. In the 3D rotational angiography image (B), the relation of parent artery and aneurysm lumen full of coils, is shown in detail.

med consent form for the intervention. Under general anesthesia, a 7F introducer was placed in the left groin, and a 5F introducer was placed into the right groin with a femoral approach. The adequacy of systemic anticoagulation was monitored by frequent measurements of the activated clotting time (ACT). A baseline ACT was obtained before bolus infusion of heparin (50–75 U/kg body weight) and monitored at hourly periods thereafter. Heparin was administered intravenously as 5000 IU at the beginning of the procedure, along with a following hourly maintenance dose of 1000IU/h. Two guiding catheters (Envoy, Cordis), 6F and 5F, were first placed into the V2 segment of left vertebral artery and right vertebral artery, respectively. However by using a microcatheter (SL-10, Boston Scientific) and 0.012 microguidewire (Terumo) via right vertebral artery, the aneurysm could not be catheterized, and the position of the guiding catheters exchanged. Finally aneurysm could be catheterized when the microcatheter was in the left vertebral artery. A 4x7 mm (Hyperform, MTI) balloon catheter was advanced to the neck of the aneurysm via right vertebral artery. Aneurysm space was filled with embolic agent by 3 3D and 2 2D Guglielmi detachable coils (GDCs, Boston Scientific). After seeing that no contrast agent passed into the aneurysm space, procedure was ended (Figure 2). No complications were encountered during and after the procedure. Following a two-day follow-up period, the patient was discharged without any neurological deficits.

DISCUSSION

Basilar artery is the second most common intracranial artery after vertebral artery where fenestration occurs. Basilar artery develops during 5th week of fetal life as a result of the fusion of two primitive longitudinal neural arteries. In the early period of the fusion, these arteries are connected with bridging areas. Fenestration develops as a result of the non-regression of the bridging areas.[1,2]

Basilar artery fenestration was first shown by Hemmati and Kim on angiography in 1979.[3] Basilar artery fenestration frequency was reported to be 0.04-0.6% in angiographies and 1.33-6% in autopsy series.[4] There are discrepancies between frequencies obtained from autopsy series and angiographic findings.[5-7] These differences may be due to inability of detecting extremely short and thin, or small fenestrations in conventional angiographies with 2D images. By multislice CT and rotational subtraction angiography, small-sized fenestrations and aneurysms can be detected owing to ability to examine the lesion from different views without any loss of resolution in any plane. In the present case, the neck and the orientation of the dome was not demonstrated adequately on 2D angiograms and with applying 3D rotational angiography, the orientation and neck of the aneurysm could be seen in detail.

In a study of Saunders et al.[6] aneurysm risk was reported to be 7% in the presence of a fenestration while Campos et al.[5] reported the frequency of the fenestration in a vertebrobasilar junction aneurysm as 35.5%. Thus, in presence of an aneurysm in vertebrobasilar junction, presence of a fenestration should be investigated. Moreover, both vertebral artery injections should be conducted separately.[1] The fenestration may develop in any segment of basilar artery; it is most commonly seen in the proximal trunkus close to the vertebral artery. Although the lateral wall of the fenestrated area has a normal structure, focal defects occur in upper and lower portions of the junction as a result of a disruption of the integrity of elasticity in the medial wall. Accompanying turbulent flow alterations due to the significant thinning of subendothelium increase the risk of aneurysm development.[4,8] In the present case, there was a fenestration in the lower portion of the basilar artery and an aneurysm formation in the proximal part of the fenestrated area.

Endovascular treatment is an alternative treatment method due to several characteristics of brain stem such as complex anatomical structure, high complication rate, and the difficulties complicating the surgical approach to this area.[9,10] As in our case, because of the complex geometry of the fenestrated vascular area, applying a clip to the aneurysm neck is further complicated. In the present case which had a vertebrobasilar artery fenestration associated with an aneurysm, we carried out the treatment of aneurysm space by coil embolization. We used balloon remodeling technique to preserve the loops of fenestration. In the present case we had to exchange the place of the balloon catheter and microcatheter for proper catheterization of the aneurysm. These kinds of catheterization problems may be encountered because of the complex anatomy and the interference of balloon catheter to microcatheter manipulations. In such circumstances both access routes must be tried for aneurysm catheterization if one of them fails.

In conclusion, aneurysms which are associated with vertebrobasilar artery fenestration may be safely treated with endovascular approach particularly by employing 3D angiography that displays the geometry of the lesion clearly.

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