

## Endovascular treatment of a traumatic facial arteriovenous fistula with transcatheter embolization technique

*Travmatik fasiyal arteriyovenöz fistülün transkateter embolizasyon tekniği ile endovasküler tedavisi*

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### ABSTRACT

Traumatic arteriovenous (AV) fistulas are the vascular lesions which usually develop due to penetrating or blunt injuries or rarely due to an iatrogenic cause. Gunshot wounds, penetrating injuries, or bone fractures which are located in an adjacent artery and vein constitute the major etiology of the traumatic AV fistulas. Arteriovenous fistulas may not be diagnosed for years and may require surgical intervention long after the injury. When a traumatic AV fistula is not treated immediately and appropriately, it may cause subacute and chronic complications. Traumatic AV fistulas may progress to rarely encountered aneurysmatic dilatations in chronic periods. In this article, we report a 33-year-old male case with a neglected traumatic AV fistula which progressed to a facial AV aneurysm and received endovascular treatment successfully using transcatheter embolization technique.

**Keywords:** Aneurysm; arteriovenous fistula; endovascular treatment; transcatheter embolization.

Acquired arteriovenous (AV) fistulas usually develop following a penetrating injury.<sup>[1]</sup> These fistulas are called as traumatic AV fistulas, as the major etiology is injury. Malignancy or infections are also among the uncommon causes. Acquired AV fistulas usually

### ÖZ

Travmatik arteriyovenöz (AV) fistüller genellikle penetran veya künt travmalar sonucu, nadiren de iyatrogenik nedenler ile oluşan vasküler lezyonlardır. Travmatik AV fistüllerin başlıca etyolojisini ateşli silah yaralanmaları, delici yaralanmalar veya komşu arter ve vene yakın kemik kırıkları oluşturur. Arteriyovenöz fistüllere yıllarca tanı konmayabilir ve travmadan uzun bir süre sonra cerrahi girişim gerekebilir. Travmatik AV fistül zamanında ve uygun şekilde tedavi edilmez ise, subakut ve kronik komplikasyonlara neden olabilir. Travmatik AV fistüller kronik dönemlerde nadiren karşılaşılan anevrizmatik dilatasyonlara neden olabilir. Bu yazıda, fasiyal AV anevrizmasına ilerleyen ihmal edilmiş travmatik AV fistülü olan ve transkateter embolizasyon tekniği kullanılarak başarılı bir şekilde endovasküler yolla tedavi edilen 33 yaşında bir erkek olgu sunuldu.

**Anahtar sözcükler:** Anevrizma; arteriyovenöz fistül; endovasküler tedavi; transkateter embolizasyon.

involve the medium and large vessels and tend to present as single. Gunshot wounds, penetrating injuries, or surgical interventions are the main causes of the etiology.<sup>[1]</sup> Repeated arterial or venous interventions may also cause iatrogenic AV fistulas. In these cases,



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clinical signs may be detected from a few hours to years after injury, revealing a delayed formation of a pulsatile mass.<sup>[1,2]</sup> Clinical diagnosis of the traumatic AV fistulas depends on the history of injury and careful physical examination consisting of palpation and auscultation. Thrill and bruit over a pulsatile mass are the main characteristic features. Distal pulses are usually palpable; however a large AV fistula may shunt away blood from the extremity, causing peripheral ischemia.<sup>[3]</sup> The Nicoladoni-Israel-Branham's sign may be also positive which means manual compression of the AV fistula causes reduced heart rate.<sup>[4]</sup>

The treatment of acquired AV fistulas is primarily surgical. Interruption of the connection between the artery and vein is sufficient for recovery. Existing vascular defects should be also repaired. Compression with the Doppler ultrasound (DUS) probe for 30 to 45 minutes over the AV fistulas was reported to be useful for the catheterization-induced iatrogenic cases. In addition, the graft coated stents may be used in certain regions. Therapeutic embolization may be used in pseudoaneurysms or in cases who are not candidate for surgery.<sup>[1]</sup> Insisted effort to perform open surgery in inappropriate patients may result in exposure difficulties, intraoperative hemorrhage, tissue damage, and postoperative scar development.



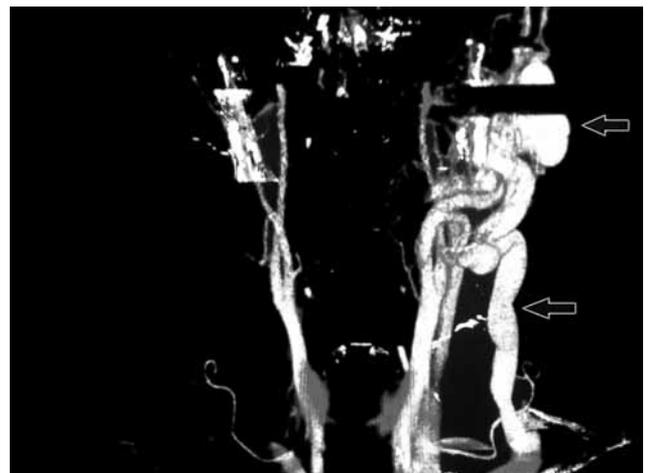
**Figure 1.** The image of the external morphology of the arteriovenous fistula (engorged jugular vein predominantly visualized).

Regarding the treatment of extracranial and peripheral vascular pathologies, progressions in endovascular methods have revealed a more promising pathway. In this article, we report a successful endovascular treatment of a rare case with a facial AV fistula and aneurysm using transcatheter embolization technique. Emphasis is particularly given to the success of the endovascular methods in the treatment of AV fistulas which are located in the face and neck which are important visible parts of the body.

## CASE REPORT

A 33-year-old male patient was admitted to our outpatient clinic with a complaint of a painful swelling on the left side of the face in front of the left ear and the left neck region. Swelling was augmenting and spreading through the chin down to the neck during exertion. His medical history was otherwise normal except the history of penetrating injury to the left side of the neck under the chin with a sharp steel object seven years ago. Swelling grown out soon after the injury and showed progression over time. It became painful and non-reducible for the past year, since the reduction was initially possible with a gentle external manual compression.

There was a strongly pulsatile mass in front of his left ear on physical examination. Sharp thrill and bruit were auscultated along the left face up to the upper margin of the ear level. External jugular vein was engorged and weak thrill all the way its trace along the neck was obtained (Figure 1). External compression of the mass reduced the size and thrill of the aneurysm and the jugular vein. Doppler ultrasound revealed



**Figure 2.** Computed tomography angiography (a three-dimensional reconstruction image) showing the vasculature (upper arrow pointing the facial aneurysm, lower arrow pointing the congested jugular vein).

an AV aneurysmatic structure located in the related region. Initially, contrasted computed tomography (CT) angiography scan (1 mm/slice) and digital subtraction angiography (DSA) were performed. An AV fistula and aneurysm with a size of 28x29 mm were detected in CT scans (Figures 2, 3). However, the distribution and quantity of feeding branches were unable to be detected clearly in either modalities. As a result, standard arteriography was further planned for the accurate diagnosis in combination with the treatment in a single session.

The intervention was performed in an angiography unit with Artis Imaging System (Siemens Healthcare, Erlangen, Germany) under general anesthesia. A 7 F sheath was inserted into the right femoral artery with the Seldinger technique. A 0.035 inch x 150 cm hydrophilic guide-wire (Terumo Interventional Systems, Somerset, NJ, USA) was used within the supporting catheters. The Cobra-1 (Glidecath) hydrophilic (Terumo Interventional Systems, Somerset, NJ, USA) and Simmons-1 (Surefire) hydrophilic (Surefire Medical Inc., The Hague, The Netherlands) supporting catheters were used. The catheters were introduced through the left common carotid artery of the arcus aorta. Arteriography revealed an AV fistula with multiple feeders originating from the facial branches of the external carotid artery (Figure 4a). Azur Peripheral Hydrocoil System (Terumo Interventional Systems, Somerset, NJ, USA) was selectively placed at the distal part of the AV fistula through the facial artery, a branch of the external carotid artery. Distal obliteration stopped the retrograde filling of the artery. N-butyl-2-cyanoacrylate (NBCA; Histoacryl; B. Braun, Melsungen, Germany) and Lipiodol (Guerbet

SA, France) mixture was selectively injected into five feeders in different locations via micro-catheter to prevent recurrences. The nidus was completely obliterated by the injection of 2.5 mL of NBCA. After the obliteration of the nidus, repeated angiogram revealed re-filling of the AV fistula by different multiple millimetric multi-feeders. Then, the main trunk of the external carotid artery was totally obliterated with NBCA (3.5 mL)-Lipiodol (10 mL) mixture including all the millimetric feeders. Repeated angiograms revealed no residual AV fistula (Figure 4b). No neurological deficit was seen after the procedure.

Following the procedure, the jugular venous engorgement disappeared and the thrill over the left face became non-palpable. He was discharged on the postoperative second day without any complication. Calcium dobesilate (1000 mg/day) was prescribed to increase and regain the venous tonus of the formerly overinflated jugular vein. Diclofenac potassium (100 mg/day) was also given for analgesia.

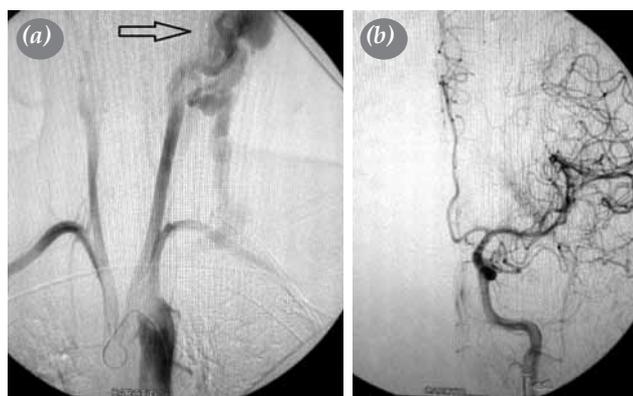
## DISCUSSION

An arteriovenous fistula was first described by William Hunter, a Scottish anatomist and physician, in 1757, who clearly defined an AV fistula and aneurysm as an abnormal communication between an artery and a vein.<sup>[5]</sup> Gilbert Breschet, then, performed the first surgical treatment in 1832 by ligating the proximal artery of an AV fistula, followed by the gangrene of the extremity. In 1843, Norris performed a successful surgical operation of an AV fistula by double ligation technique.<sup>[5,6]</sup>

The AV fistulas and pseudoaneurysms (PAs) usually occur following penetrating or iatrogenic injuries. Arteriovenous fistulas are rarely associated



**Figure 3.** Computed tomography (contrasted) showing transverse view of the facial aneurysm.



**Figure 4.** Arteriography before (a) and after (b) the endovascular treatment (arrow pointing the initial facial aneurysm) (images were taken in cranial-18 degree of angle).

with PAs and both should be immediately treated upon diagnosis. They may cause serious complications such as rupture, neuropathy, distal thromboembolism, and thrombosis.<sup>[7]</sup> Chronic AV fistulas may even appear as progressive arterial dilatation, chronic venous insufficiency, and congestive heart disease.<sup>[8,9]</sup> Therefore, penetrating injuries near or adjacent to a vascular structure should be suspiciously investigated and auscultation should never be omitted. Medical history and physical examination are particularly important in patients with traumatic AV fistulas. A palpable thrill and systolic diastolic murmur are pathognomonic signs.<sup>[10]</sup> Bradyarrhythmia triggered by the external manual collapse of the AV fistula (Nicoladoni-Israel-Branham's sign) is of utmost significance for the diagnosis.<sup>[4]</sup>

Following the initial DUS investigation, CT, DSA or an angiography investigation should be further performed in case of a certainty based on the physical examination findings.<sup>[10]</sup> Doppler ultrasound is widely used in the diagnosis of the AV fistulas, whereas arteriography, CT angiography, and DSA scans are particularly critical to investigate the location, distribution, and the number of the fistulas, as well as the detection of the collateral circulation.<sup>[1]</sup> In addition, magnetic resonance imaging (MRI) is primarily used in congenital AV fistulas involving the bones and muscular tissue. Magnetic resonance imaging and arteriography have also complementary roles in identifying the treatment strategy.<sup>[2]</sup>

Arteriovenous fistulas are mostly treated with surgical excision, double ligation, and primary repair. Pain, aesthetic deformity, dermal erosion, and the possibility for rupture are the major surgical complications.<sup>[10]</sup> Recently, transcatheter embolization and ultrasound-guided compression have been widely used as an alternative to the standard surgical modalities.<sup>[11-13]</sup> Regarding the AV fistulas of head and neck, intra-arterial occlusion therapy may be the treatment of choice alone or may be a supplement to the classical surgery.<sup>[14]</sup> In this case, endovascular treatment strategy with the transcatheter embolization technique was primarily considered, as the lesion was inappropriately located for the surgical management. In addition, surgical scar on the face of a young patient would not be aesthetically well tolerated.

During the procedure, general anesthesia was deliberately preferred merely, since an absolute immobility of the patient was necessary for the precise intervention. Although it is not a strict need, general anesthesia offers a comfort for the surgeon,

as the duration of the process usually cannot be preoperatively predicted.

Although some of the post-traumatic AV fistulas have the capability to resolve spontaneously, they should be diagnosed and treated as early as possible. Any delay in the treatment may complicate the disease by chronic local and systemic problems.<sup>[15]</sup> Furthermore, patients with extracranial AV fistulas should be encouraged to be treated, as they often have the apprehension of a surgical scar on their face.

In conclusion, endovascular methods should be alternatively considered in the treatment of AV fistulas depending on the location, dimension, and proximities of the fistulas.<sup>[16]</sup> Although the surgical option remains as the conventional method, endovascular modalities such as transcatheter embolization can be successfully used with many advantages in selected patients, as in our case.

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