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Ultrasound diagnostics of a spontaneous arteriovenous fistula of the head and neck

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Abstract

An arteriovenous fistula is an abnormal connection between the arterial and venous systems. In the literature, there are well-described ultrasound findings of iatrogenic arteriovenous fistula as a potential complication from percutaneous transarterial or transvenous procedures. The most important sign is direct visualization of the fistula in the place of the access site. It is necessary to look for secondary signs of arterialization of the veins, which can suggest a diagnosis of an arteriovenous fistula. However, the accuracy and diagnostic quality of duplex scanning in the diagnostics of a congenital or spontaneous arteriovenous fistula of the head and neck area in adults have been poorly described in the literature. In this study, we discuss the opportunities of duplex scanning, based on two different cases of an arteriovenous fistula revealed by ultrasound and then confirmed by computer tomographic angiography.

Introduction

According to the International Society for the Study of Vascular Anomalies/Biologic Classification, vascular lesions have been divided into vascular tumors and vascular malformations^(1–3). Based on the rate of blood flow, vascular malformations have been divided into “slow flow” (capillary, venous, lymphatic or mixed) and “high flow” (arterial, arterio-venous fistulae or shunt) subtypes⁽²⁾.

The generally accepted method of diagnosis of an arteriovenous fistula (AVF) is still considered to be traditional digital subtraction angiography (DSA), but computed tomographic angiography (CTA) and magnetic resonance angiography (MRA) can also be used for the diagnosis of these vascular lesions.

DSA has potential risks, such as neurological procedural complications and ionizing radiation exposure. CTA examination also has a high ionizing radiation dose, and may cause an anaphylactic reaction to the contrast agent. MRA is an important tool in the diagnostics of vascular lesions, but it is expensive. Furthermore, MRA examination has some contraindications. DS examinations of cervical vessels are

used in clinical practice as a less invasive alternative to DSA for the diagnosis of vascular lesions in the cervical area⁽³⁾.

In the literature, there are well-described ultrasound findings of iatrogenic AVF. In these cases, authors most commonly report such features as direct visualization of fistula and secondary signs of arterialization of the veins. However, the potential opportunities of DS in the diagnostics of congenital spontaneous AVF of the head and neck in adults have been poorly described in the literature. Iatrogenic and congenital AVF have the same pathogenetic mechanism – the existence of a communication between the arterial and the venous system. Hence, the need for a discussion of the potential role of duplex scanning for the diagnosis of congenital or spontaneous AVF. It is necessary to clarify that if the AVF is large, presents as a mass, and causes serious symptoms, the diagnosis can be made based on clinical examination. We are presenting and discussing two cases of ultrasound diagnosis of AVF in adults, which did not have typical clinical findings of AVF, and caused only intermittent, annoying non-pulsatile tinnitus.

Ultrasound examinations were performed with Logiq 9 scanner equipped with linear, convex and microconvex probes.

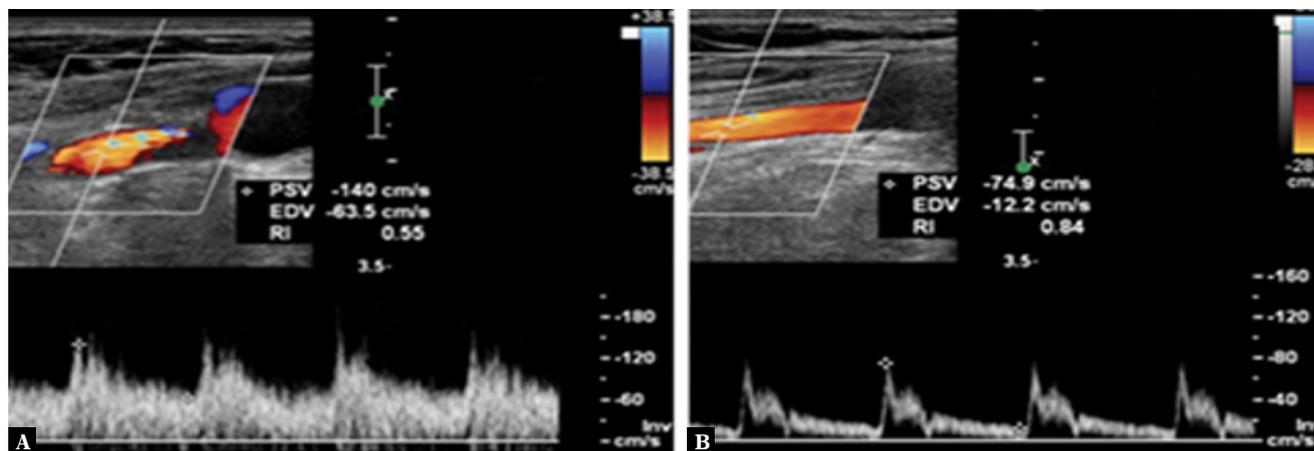


Fig. 1. Spectral Doppler of the left ECA (A) and the right ECA (B)

The parameters of spectral Doppler from the carotid arteries and jugular veins on both sides were obtained and recorded.

Case reports

Case 1

A 48-year-old female was admitted to our clinic with annoying non-pulsatile tinnitus in the left ear of five month's duration. She had no history of trauma. On examination, a slight murmur over the left retroauricular region was audible. Neurological examination showed no abnormalities. DS examination demonstrated a decrease of the resistive index and increase of the blood flow velocity in the left external carotid artery (ECA) compared with the right side (Fig. 1), as well as arterialization of the blood flow in the left internal jugular vein (Fig. 2). The resistive index in the left external carotid artery was 0.55, peak systolic velocity 140 cm/s, end-diastolic velocity 64 cm/s, in the right ECA 0.84, 75 cm/s, 12 cm/s, respectively.

We also found a difference between the diameter of the right and the left ECA: the diameter of the right ECA was 4.3 mm, and the diameter of the left ECA was 5.8 mm.

DS revealed multiple tortuous dilated branches from the occipital artery feeding the AVM. The nidus was a diffuse network of dilated vessels in the post auricular region with multiple shunts. The existence of arterialization in the internal jugular vein suggested draining veins to drain into the internal jugular vein (Fig. 3).

CTA confirmed the existence of a fistulous communication between the left occipital artery and the left internal jugular vein (Fig. 4).

Case 2

A 66-year-old female was admitted to our clinic with annoying non-pulsatile tinnitus in the right ear of two month's duration; sometimes the tinnitus disturbed her sleep. She reported no history of trauma. Auscultation of this area was unremarkable, she was completely normal.

DS showed a decrease of the resistive index in the right external carotid artery (ECA) and an increase in the blood flow velocity compared with the left side, but the differences did not appear significant (Fig. 5). The resistive index in the right external carotid artery was 0.69, peak systolic

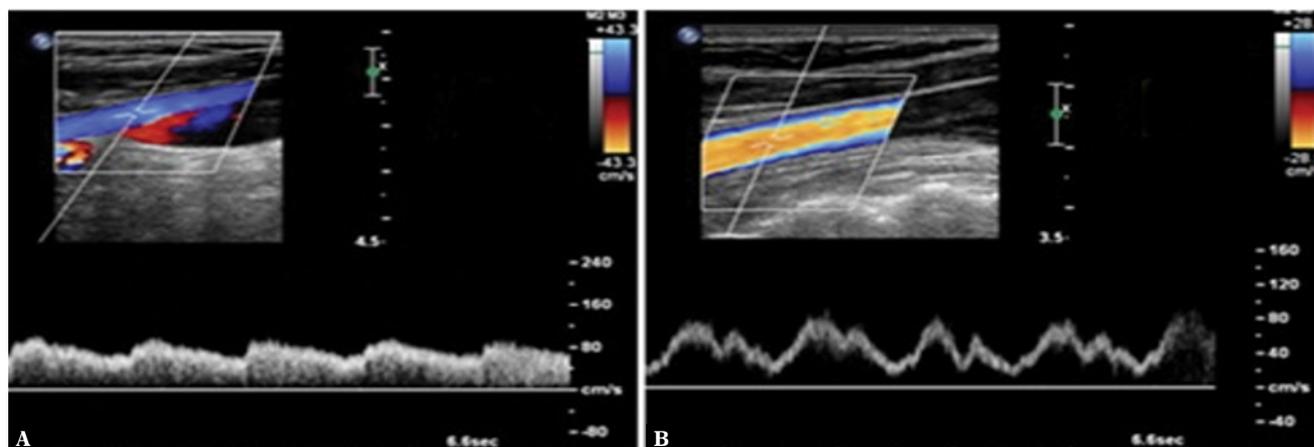


Fig. 2. Spectral Doppler of the left internal jugular vein (A) and the right internal jugular vein (B)

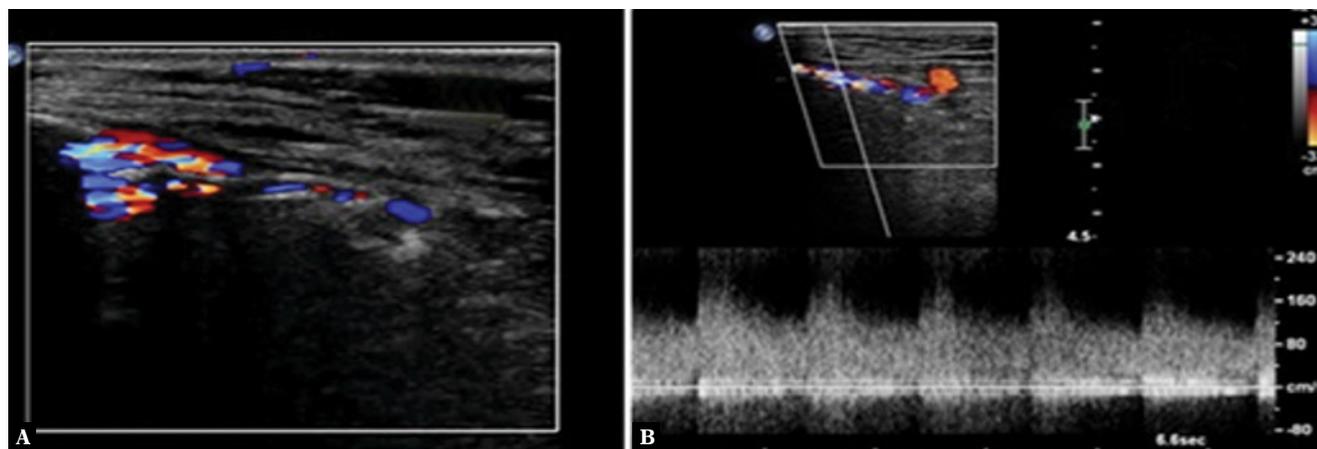


Fig. 3. Branches of the occipital artery (A) and the blood flow (B)

velocity 115 cm/s, end-diastolic velocity 36 cm/s, in the left ECA 0.75, 86 cm/s, 21 cm/s, respectively.

In addition, DS revealed multiple tortuous dilated branches from the posterior auricular artery with increasing blood flow, feeding the AVF (Fig. 6a). The nidus was a diffuse network of dilated vessels in the post-auricular region with suspected multiple shunts (Fig. 6b). There were no findings of arterIALIZATION of the blood flow in the external and internal jugular veins, suggesting that draining veins finally drained into the deep cervical vein.

CTA examination confirmed an AV fistula between the branches of the external carotid artery and the deep neck vein (Fig. 7).

Discussion

Arteriovenous malformations represent persistence of embryonic arteriovenous shunts⁽⁴⁾. History and physical examination can be useful in diagnosing a superficial arteriovenous fistula in the head and neck⁽⁴⁻⁷⁾. AVF is very rare in the postauricular region⁽⁵⁾. There are only a few

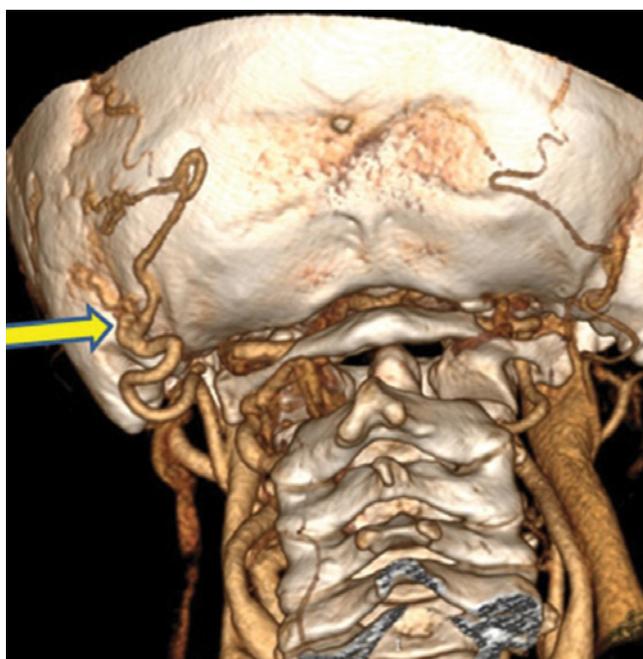


Fig. 4. CTA. Back view. The nidus (yellow arrow)

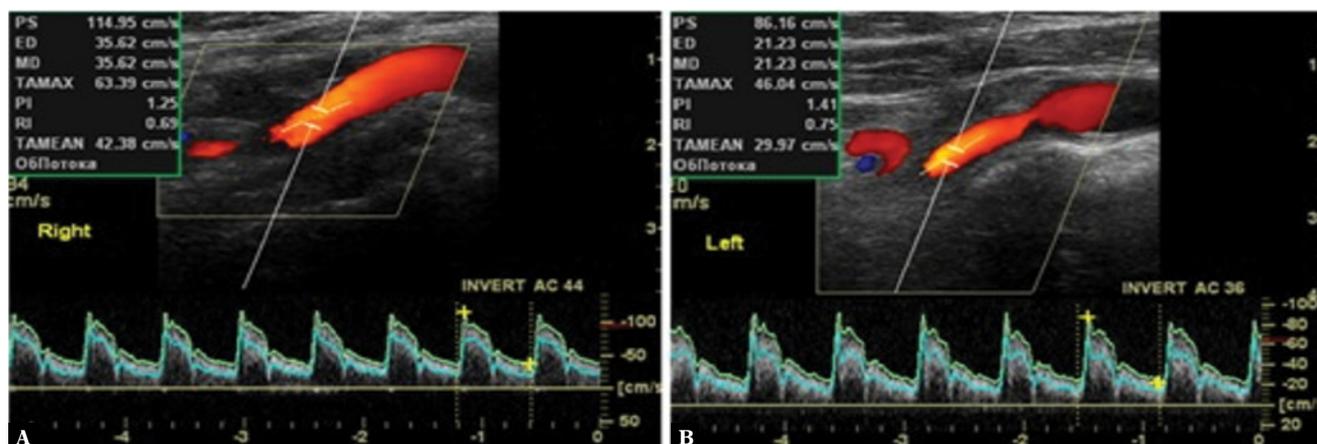


Fig. 5. Spectral Doppler of the right ECA (A) and the left ECA (B)

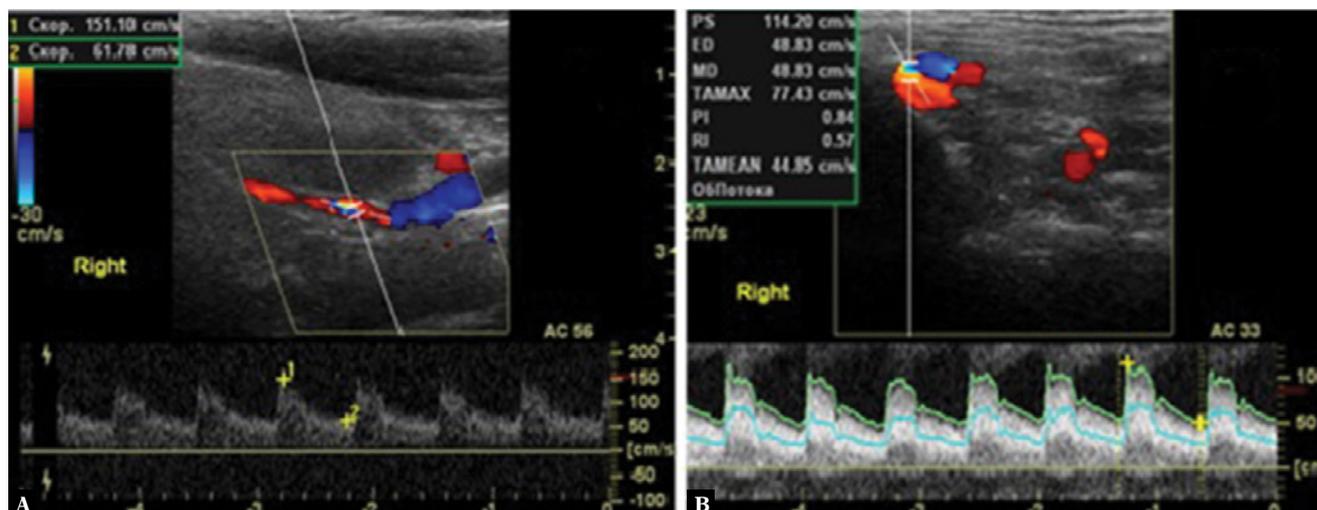


Fig. 6. **A.** The branch of ECA supplying the nidus. **B.** The blood flow in the nidus of AVF

documented cases of AVF in the postauricular region in English-language literature.

The external carotid artery supplies blood to the structure of the face and neck. Arteries in skeletal muscle are known to have a tendency for low diastolic flow. End arteries in skeletal muscle are contracted and resistance in the arterial bed is high. We are reporting two cases of AVF because of its rarity. It was diagnosed by color Doppler sonography as multiple dilated tortuous vessels arising from the posterior auricular artery, with increasing blood flow.

We have found two special findings of AVF. The most important spectral Doppler evidence is an increase in the amount of diastolic flow (and a corresponding decrease in the resistive index).

In the first case, the systolic velocity in the left ECA was about two times higher when compared with the right ECA, and the diastolic velocity was about five times higher. In the second case, the same tendency was demonstrated:

on the AVF side, the diastolic velocity increased more than the systolic velocity.

In the presence of arteriovenous shunting, the resistance to blood flow is significantly reduced, and, consequently, the general velocity of the blood flow in the supplying arteries increases depending on the size of the malformation.

Thus, high diastolic flow means that the incoming artery has the possibility of shunting into a low-resistance vein. Other evidence is potential detection of shunts in the nidus. An additional feature is a significant difference in the lumen of the external carotid artery, with the diameter of the artery supplying the AVF being larger.

If AVF is small and asymptomatic, no treatment is required⁽⁴⁻⁷⁾. For symptomatic AVF, complete excision is the treatment of choice. In the cases we have described here, tinnitus was likely associated with the presence of a specific vibration occurring due to the fistula, transmitted through the bone structure to the structures of the ear.

In the first case, simple ligation of the feeding vessel was successfully performed. In the second, because of the small size of the nidus and intermittent manifestation of the symptoms conservative treatment was used.

We have demonstrated color Doppler ultrasonography to be in some cases a method sensitive enough for the identification of such lesions. Pursuit of surgery opportunities usually requires DSA or CTA^(4,7). We consider the presence of annoying non-pulsatile tinnitus to require ruling out the possibility of AVF, which is likely to occur more frequently than previously reported.

Conflict of interest

The authors do not declare any financial or personal links to other people or organizations that could adversely affect the content of this publication or claim rights hereto.



Fig. 7. CTA. Back view. The connection between arterial branches and the deep cervical vein (yellow arrow), the drained deep cervical vein (white arrow)

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