CASE REPORT

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Clinical and color Doppler imaging features of one patient with occult giant cell arteritis presenting arteritic anterior ischemic optic neuropathy

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Abstract

Anterior ischemic optic neuropathies (AIONs) represent a segmental infarction of the optic nerve head (ONH) supplied by the posterior ciliary arteries (PCAs). Blood supply blockage can occur with or without arterial inflammation. For this reason, there are two types of AIONs: non-arteritic (NA-AION), and arteritic (A-AION), the latter is almost invariably due to giant cell arteritis (GCA). GCA is a primary vasculitis that predominantly affects extracranial medium-sized arteries, particularly the branches of the external carotid arteries (including superficial temporal arteries – TAs). One patient with clinical suspicion of acute left AION was examined at admission following a complex protocol including color Doppler imaging (CDI) of orbital vessels, and color duplex sonography of the TAs and of the carotid arteries. She presented an equivocal combination of an abrupt, painless, and severe vision loss in the left eye, and an atypical diffuse hyperemic left optic disc edema. She had characteristic CDI features for GCA with eye involvement: high resistance index, with absent, or severe diminished blood flow velocities, especially end-diastolic velocities, in all orbital vessels, especially on the left side (A-AION). Typical sonographic feature in temporal arteritis as part of GCA was "dark halo" sign. On the other hand, she did not present classic clinical or systemic symptoms of GCA: temporal headache, tender TAs, malaise (occult GCA). The left TA biopsy confirmed the diagnosis of GCA. The ultrasound investigations enabled prompt differentiation between NA-AION and A-AION, the later requiring in her case immediate steroid treatment, to prevent further visual loss in the right eye.

Keywords: arteritic or non-arteritic anterior ischemic optic neuropathies (A-AIONs or NA-AIONs), occult giant cell arteritis (occult GCA), color Doppler imaging of orbital vessels, high resistance index, dark halo sign.

Introduction

Anterior ischemic optic neuropathies (AIONs) represent an acute ischemic disorder (a segmental infarction) of the optic nerve head (ONH) supplied by the posterior ciliary arteries (PCAs: nasals and temporals) [1–10]. Blood supply blockage can occur with or without arterial inflammation. For this reason, AION is of two types: arteritic (A-AION), which is almost invariably caused by giant cell arteritis (GCA), and non-arteritic (NA-AION), which is a multi-factorial disease (the nocturnal arterial hypotension being the most important risk factor) [1–10]. Frequently, in NA-AION an anatomical predisposition is observed: small discs (presence of "disk at risk"), where structural crowding of nerve fibers, and reduction of the vascular supply may combine to impair perfusion to a critical degree [1–10]. On the other hand, GCA is a primary vasculitis that predominantly affects extracranial medium-sized arteries, especially branches of the external carotid arteries (ECAs), including the superficial temporal arteries (TAs) and sometimes large-sized arteries: the aorta and its major branches (large-vessel GCA) [1–14]. Approximately 50% of patients with GCA have ophthalmologic complications, including visual loss secondary to A-AION, or central retinal artery occlusion [1–17], which require immediate steroid treatment, to prevent further visual loss in the other eye [6–18]. The typically predominant extracranial vascular involvement (including the orbital vessels) is explained by the affinity of inflammation to the elastic fibers in the media. As intracranial arteries have less elastic fibers in the media, they are seldom involved [1–17]. The diagnosis of GCA is made following the criteria of the *American College of Rheumatology* [14] and requires at least three of the following five diagnostic criteria: age more than 50 years at disease onset, new headache in the temporal area, TAs tenderness, and/or reduced pulse, jaw claudication, systemic symptoms (malaise, fever, etc.), erythrocyte sedimentation rate (ESR) exceeding 50 mm/h, and typical histological findings (granulomatous involvement) in temporal artery biopsy (TAB) [6–17].

We report here a rare case of a patient with a left AION induced by an occult GCA (because she did not present classic clinical or systemic symptoms of GCA: temporal headache, malaise, etc.). The main purpose of our paper is

to show the essential role of color Doppler imaging (CDI) of orbital vessels to quickly elucidate (less than thirty minutes) the arteritic mechanism of AION in our patient with equivocal ophthalmological features of A-AION. So, in her ocular emergency we used (before TAB and histological findings) immediate treatment with systemic corticosteroids to prevent further visual loss of her right eye.

Case presentation

A 72-year-old hypertensive, diabetes mellitus woman was referred to our Departments of Ophthalmology and Neurology, in March 2015, the same day she had observed (in the morning) the abrupt onset of a permanent visual loss of her left eye. She gave informed consent and was examined at presentation, and in the next two days following a complex protocol, including:

(1) A complete history of all previous or current systemic diseases.

(2) An ophthalmological evaluation, including visual acuity with the Snellen visual acuity chart, visual fields with a Goldmann perimeter, relative afferent pupillary defect, intraocular pressure, slit-lamp examination of the anterior segment, lens and vitreous, direct ophthalmoscopy and color fundus photography (the last two procedures were repeated at two weeks after the onset of the visual loss), and fluorescein fundus angiography.

(3) A color Doppler imaging (CDI) of orbital vessels, which was done with a sonographer with a 10 MHz linear probe for detecting (by color Doppler sonography), and measuring (by spectral analysis pulsed Doppler sonography) the blood flow in the orbital vessels: the ophthalmic arteries (OAs), the central retinal arteries (CRAs), the PCAs (nasals and temporals), and the superior ophthalmic veins.

(4) An assessment of extracranial arteries, which was realized with a 7.5–10 MHz linear array transducer, combining both B mode and color Doppler/pulsed-wave Doppler ultrasound (extracranial duplex sonography – EDS) to determine an eventual carotid source of emboli, and with a 10 MHz linear probe for the examination of ECA's branches, especially TAs. CDI of retrobulbar vessels and EDS examinations were performed by the first two authors of the study before corticosteroid treatment.

(5) A physical examination, including the TAs, to detect an eventual temporal arteritis as part of GCA.

(6) A laboratory workup, including ESR, C-reactive protein (CRP), factor V Leiden, glycemia, etc.

(7) An EKG (electrocardiogram) and a transthoracic echocardiography (TTE) to detect an eventual cardiac source of emboli.

(8) A cranial computed tomography (CT), which was performed with the purpose of excluding stroke.

(9) A CT-angiography (CT-A), which was performed immediately after CT. It allowed the analysis of the arterial wall and the endoluminal part of the aorta and its branches in order to exclude large-vessel GCA, and/or ipsilateral severe ICA stenosis.

(10) Finally, we proceeded to a TAB, which was done in the second day after hospital admission, after initiating corticotherapy in the first day. In the presence of left clinical ocular involvement, we took a biopsy from the left TA guided by EDS, representing 2.5 cm of the affected ramus. Serial sections were examined, as there could be variations in the extent of involvement along the length of the artery.

Ophthalmologic features

She presented a permanent, abrupt, painless, and severe loss of vision of the left eye installed on the day of the hospital admission. On examination, visual acuity was 0.02 for the left eye and 0.8 for the right eye, with a diffuse hyperemic optic disc edema of the left eye, which developed two weeks after the onset of permanent visual loss (Figure 1). The optic disc of the right eye had a normal diameter/normal physiological cup. The anterior segment examination of both eyes was normal in her case.

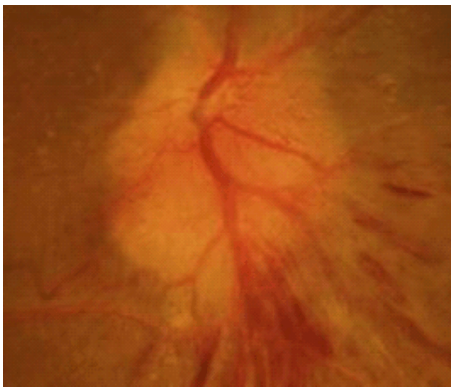

Figure 1 – ***Fundus view of the left eye. Arteritic anterior ischemic optic neuropathy (A-AION) with an atypical diffuse hyperemic optic disc edema.***

Color Doppler imaging (CDI) of retrobulbar (orbital) vessels

At presentation (in acute stage), blood flow could not be detected in the PCAs (both nasals and temporals) in the clinically affected left eye. Low-end diastolic velocities (EDV) and increased resistance index (RI) were identified in all other retrobulbar vessels from both eyes (including the left CRA) (Figure 2, A and B).

Fluorescein fundus angiography

Fluorescein fundus angiography was achieved after the CDI of retrobulbar vessels, and suggested a left PCA thrombotic occlusion, with absence of optic disc and choroidal perfusion.

Classic clinical symptoms of GCA and systemic manifestations of GCA with eye involvement

The patient had no classic clinical symptoms of GCA (temporal headache, abnormal TAs on palpation, scalp tenderness, or jaw claudication). She did not present systemic symptoms or signs of GCA either (fever, malaise, fatigue, or weight loss), however, the only clinical sign was permanent visual loss of the left eye (occult GCA).

Laboratory findings

ESR was equivocal: 40 mm/h (normal values – NVs 2–13 mm/h), and CRP was increased in his case: 22.04 mg/dL (NVs<0.5 mg/dL).

Extracranial duplex sonography (EDS)

We investigated almost completely the whole length of the TAs, including the frontal and parietal branches, and found that inflammation was segmental (discontinuous arterial involvement). We identified typical sonographic features for temporal arteritis as part of GCA: a "dark halo" sign (hypoechoic, circumferential wall thickening around the lumen of an inflamed portion of the parietal ramus of the left TA, which represented vessel wall edema) (Figure 3), and an occlusion of the temporal ramus of the left TA. On the other hand, we did not identify other characteristic sonographic signs of temporal arteritis as part of GCA ("dark halo" sign, stenosis or occlusion of the right TA, or other branches of both ECAs: facial arteries, internal maxillary arteries, etc.).

Miscellaneous investigations

CT excluded stroke. EDS, CT-A, EKG, and TTE excluded any carotid/cardiac source of emboli for the left AION.

Temporal artery biopsy (TAB) and histological findings

TAB was guided by the EDS because of discontinuous arterial involvement in GCA ("skip lesions"). It was positive at the level of the portion with occlusion of the temporal ramus of the left TA. We observed intimal thickening, internal limiting lamina fragmentation (Figure 4).

Treatment and evolution

Treatment was initiated before TAB, at admission, with intravenous Methylprednisolone 1 g/day for three consecutive days, followed by oral Prednisone 60 mg daily for one month. The daily dose was then reduced by 5 mg weekly until the level of 10 mg was reached in June 2015. The patient presented stationary ophthalmologic evolution at four months (visual acuity was 0.8 for the right eye, and left visual loss was permanent in June 2015), without classic clinical symptoms of GCA and any systemic manifestations.

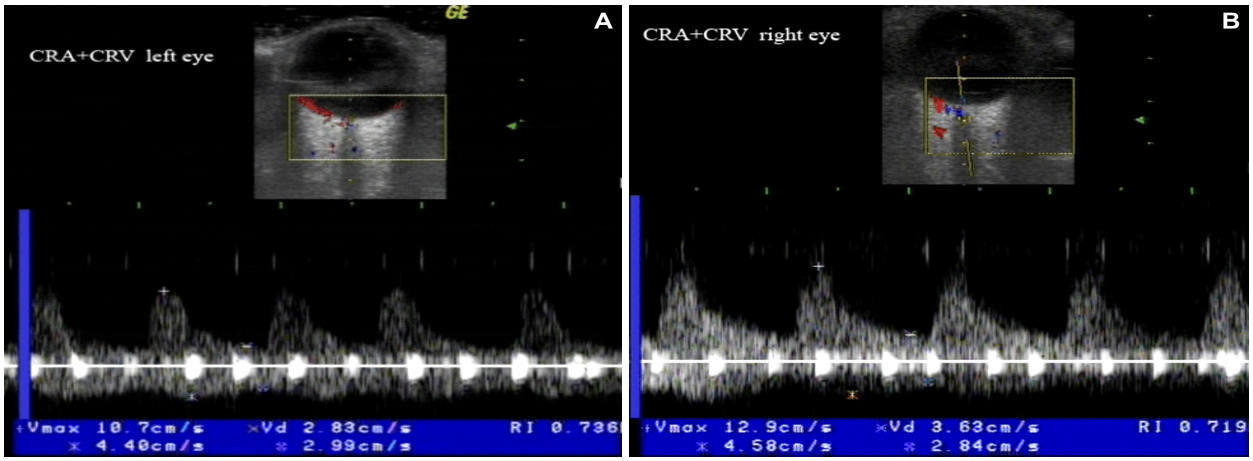

Figure 2 – ***(A) CDI of the left CRA's. Increased resistance index (RI). (B) CDI of the right CRA's. Increased resistance index (RI).***

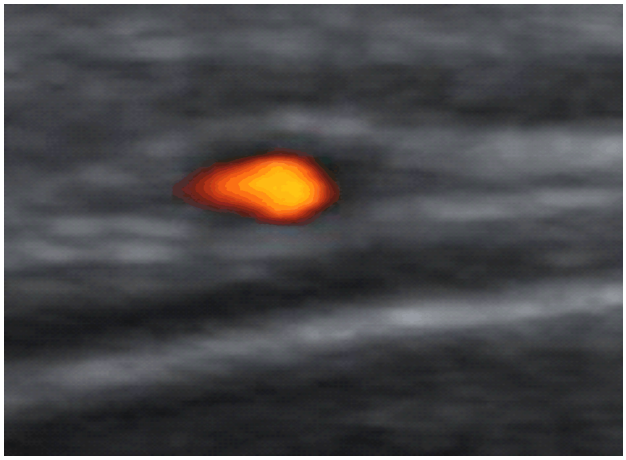

Figure 3 – ***EDS of the parietal ramus of the left TA. "Dark halo" sign.***

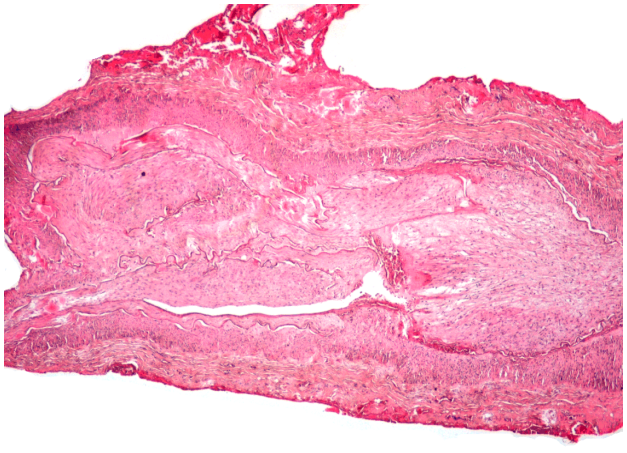

Figure 4 – ***The histopathological picture of left temporal artery biopsy – giant cell arteritis (HE staining, ×40). Higher magnification showing thickened vascular wall, internal limiting lamina fragmentation, and occlusion of the temporal ramus of the left TA (thrombus).***

Discussion

Our patient presented a left atypical A-AION, due to an occult GCA [17]. It resulted from PCA's vasculitis and the consecutive left ONH infarction. Human autopsy studies of acute A-AION demonstrated optic disc edema with ischemic necrosis of the prelaminar, laminar, and

retrolaminar portions of the optic nerve and infiltration of the PCA's by chronic inflammatory cells. In some cases segments of these vessels have been occluded by inflammatory thickening and thrombus [1–10].

Typically for A-AION, the permanent severe visual loss can be preceded by transient visual loss similar to that of carotid artery disease (*amaurosis fugax*), which was not our case [1–10]. This symptom is unusual in NA-AION [1–10]. Studies of ophthalmoscopy indicate that pallor is associated with the edema of the optic disc more frequently in the A-AION than in NA-AION, but our patient presented an atypical diffuse hyperemic left optic disc edema, which is much more suggestive for NA-AION [1–10]. The optic disc of her right eye was of normal diameter, with a normal physiological cup (absence of „disk at risk" met in NA-AION) [1–10]. Although initial simultaneous bilateral involvement is rare in A-AION, about 65% [1–18] of untreated patients with unilateral A-AION become blind in both eyes within a few weeks, this was not the case of our patient, which was treated at four months of evolution (June 2015).

The spectral Doppler analysis of the orbital vessels in our patient with A-AION revealed in the acute stage low blood velocities, especially EDV, and high RI in all retrobulbar vessels, in both orbits (with absence of blood flow in the clinically affected left PCA's). In contrast, in NA-AION blood flow velocities and RI in PCA's are relatively preserved [6–10, 19–21]. Extremely delayed or absent filling of the choroid has been depicted as a fluorescein angiogram characteristic of A-AION and has been suggested as one useful factor by which A-AION can be differentiated from NA-AION, just as in our case [1–10]. CDI of retrobulbar vessels data and fluorescein angiogram data supported the hypothesis of involvement of the entire trunk of the PCA's in our patient with A-AION (impaired optic disc and choroidal perfusion) [1–10, 19–21]. In contrast, in the NA-AION patients, the impaired flow to the ONH is distal to the PCA's themselves, possibly at the level of the paraoptic branches (only 1/3 of the flow of the SPCA's). These branches supply the ONH directly (impaired optic disc perfusion, with relative conservation of the choroidal perfusion) [1–10, 19–21].

Because of segmental (discontinuous) involvement of TAs in GCA, the TAB has to be guided in all cases with clinical suspicion of A-AION due to GCA by EDS of TAs (in our case the portion with occlusion of the temporal ramus of the left TA) [22–24]. Schmidt demonstrated that the most specific (almost 100% Sp) and sensitive (73% Se) sign for GCA is a concentric hypoechogenic mural thickening "halo", which was interpreted as vessel wall edema, like in our case [22]. Other positive findings for GCA are the presence of occlusion (like in our patient case) and stenoses [22]. The EDS of TAs must be performed before corticosteroid treatment, or within the first seven days of treatment because the "halo" revealed by TAs ultrasound disappears within two weeks of corticotherapy) [22–24].

On the other hand, Schmidt compared the results of EDS of TAs with the occurrence of visual ischemic complications (including A-AION) in 222 consecutive patients with newly diagnosed, active GCA. Unfortunately, he suggested that findings of EDS of TAs did not correlate with eye complications (including A-AION) [22].

Conclusions

For this reason, and because of the fact that our patient with occult GCA presented equivocal clinical features of A-AION, CDI of the retrobulbar (orbital) vessels rapidly differentiated in her case A-AION from NA-AION, which allowed us to initiate immediate steroid treatment, thus preventing any further visual loss in the right eye.

Conflict of interests

The authors declare no conflict of interests.

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