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SHORT COMMUNICATION

Limitations of color Doppler sonography in the imaging of ocular vessels

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PURPOSE. *To describe a case where detection of blood flow in the central retinal artery and the central retinal vein was limited by an artifact evoked by the optic disc drusen.*
METHODS. *Case report.*
RESULTS. *During color Doppler sonography, examination of optic disc drusen may generate an artifact – the so-called twinkling artifact – which can simulate blood flow and make evaluation of the central retinal vessels impossible.*
CONCLUSIONS. *Twinkling artifact does not allow evaluation of color Doppler sonography in the imaging of ocular vessels. (Eur J Ophthalmol 2004; 14: 584-7)*

KEY WORDS. *Color Doppler sonography, Ocular vessels, Drusen*

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INTRODUCTION

Color Doppler sonography of the eye provides valuable diagnostic information and is commonly used for the evaluation of retrobulbar blood flow in such diseases as glaucoma, retinal and choroidal detachment, orbital varices, arteriovenous malformations, and vessel thrombosis (1-6).

Successful application of color Doppler sonography in the diagnosis of ophthalmologic conditions may be hampered by the presence of strongly hyperechoic structures within the orbit (7).

Most often hyaline may accumulate within the anterior, prelaminar part of the optic nerve to form deposits, known as drusen (8). They tend to calcify and exert pressure on the central retinal artery and/or vein, sometimes even completely compromising the flow in these vessels (9, 10).

When exposed to the acoustic beam, drusen can reflect and dissipate ultrasound waves. This may not only prevent imaging of the central retinal vessels beyond the drusen, but also generate an artifact which can imitate blood flow (the twinkling artifact).

The latter arises when ultrasounds are randomly reflected by numerous foci of calcifications and particular secondary waves reach the detector with a slightly different delay.

According to the Doppler principle, this is seen on the color display as a rapidly changing mixture of colors, which can simulate an image of the complex of retinal vessels, i.e., central retinal artery and vein. Nevertheless, when the sample volume is placed on this color mosaic, only reverberating vertical lines are obtained instead of a blood flow spectrum (7).

In this report, we present a patient with bilateral optic disc drusen in whom detection of blood flow in the central retinal artery and the central retinal vein was prevented by the twinkling artifact in one eye.

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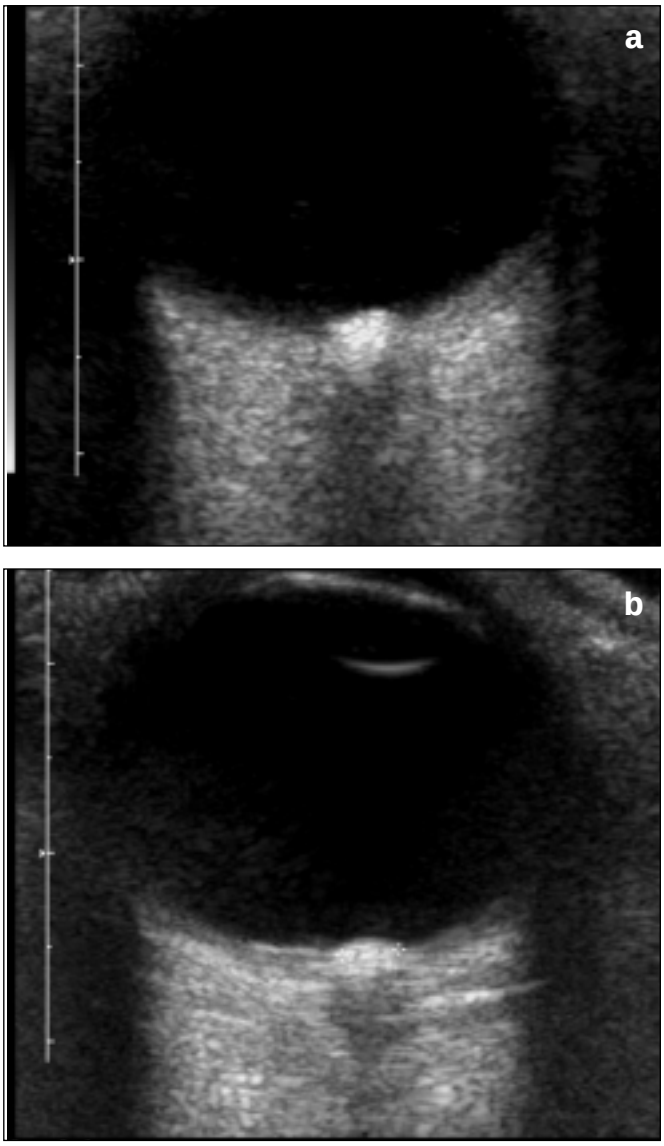

Fig 1 - *Gray scale sonograms showing optic disc drusen in the left eye* **(a)** *and the right eye* **(b)**.

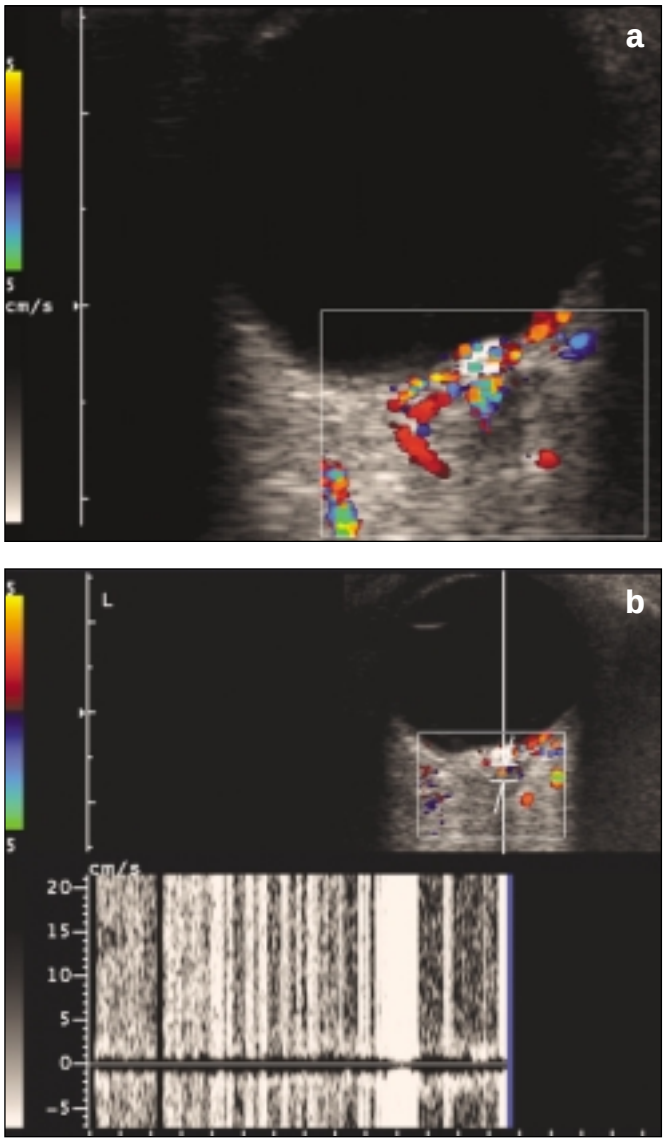

Fig 2 - *Color Doppler sonograms of the left eye showing the twinkling artifact: color mosaic behind optic disc drusen* **(a)** *and reverberating vertical lines instead of blood flow spectrum* **(b)**.

Case report

A 63-year-old man with restricted peripheral field vision of the right eye and extensive central and peripheral visual field loss of the left eye was examined with gray scale sonography. Hyperechoic lesions were found bilaterally on the surface of the optic discs (Fig. 1, a and b). The diagnosis of optic nerves drusen was confirmed with computed tomography. Color Doppler sonography was recommended in order to evaluate blood flow in the retrobulbar vessels: the ophthalmic artery, central retinal artery and vein, and the posterior ciliary arteries. The examination was performed using a Siemens Elegra unit equipped with a 9 MHz linear array transducer. To avoid any pressure on the eye, the transducer was applied gently to the closed eyelid with the use of coupling gel. The color Doppler gain during the examination was set to the point just below the threshold for color noise. The color signal was used as a guide to obtain the spectrum. The ve-

locity scale was adjusted to individual vessels. Blood flow was detected and velocity spectrum evaluated in the vessels of the right eye and the ophthalmic and posterior ciliary arteries of the left globe. The central retinal artery and vein of the left eye could not be visualized, because at the site corresponding to the localization of these vessels, behind the drusen, only a color mosaic was seen (Fig. 2a). When the sample volume was placed on this mosaic, close vertical bands with no outer wrapping appeared instead of the typical spectrum of blood flow (Fig. 2b). This was recognized as an artifact – the twinkling artifact – evoked by the optic nerve drusen. Color Doppler sonography was repeated after 5 weeks, during which the patient was treated with vasodilative drugs. On repeated examination, neither the central retinal artery nor the vein of the left eye could be visualized.

DISCUSSION

This case report demonstrates a potential limitation of color Doppler sonography in the imaging of ocular vessels. The mix of color points, which appeared at a site corresponding to the central retinal artery and vein of the left eye, might erroneously suggest the presence of blood flow in these vessels. Spectral Doppler revealed that the colors were not related to blood flow, but actually to the twinkling artifact evoked by the drusen.

The twinkling artifact was first described by Rahmouni et al as occurring behind parenchymal calcifications in prostate, breast, testis, kidney, liver, etc. (11). Its appearance was also reported in patients with a micro–coil inserted within a cerebral aneurysm, encrusted ureteral stents, and urinary calculi (12-14). We have observed this artifact during examination of the orbit as caused by drusen, a foreign metallic body, and calcifications within the phthisic bulb (7).

In vitro studies have shown that the twinkling artifact is generated by granular structures composed of many individual reflectors such as sodium chloride, iron filings, emery paper, and ground chalk, whereas no color signal is obtained after insonation of a flat interface of smooth steel or brass wire (11). This is probably why the artifact was not detected behind the drusen of the right eye, whose surface appears more flat and smooth. Also, Rahmouni et al have reported the artifact in only 42 out of 140 parenchymal calcifications located in different organs (11).

In the case described, the twinkling artifact seen in the color Doppler examination was generated by calcified drusen – strongly reflecting structures with a rough surface. If the sonographer is not aware of such artifact, evaluation of ocular vessels may be prone to misinterpretation. Although optic nerve drusen are not very frequent (0.3% of general population), these patients are often referred for sonography examination because of visual deficits caused by the lesion. Therefore, if the presence of optic nerve drusen is suspected, spectral imaging must always be obtained to determine flow in the central retinal artery and vein. Nevertheless, the twinkling artifact can sometimes make evaluation of blood flow in the central retinal vessels impossible.

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