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A **Case Report**

Visibility of Blood Flow on Optical Coherence Tomography Angiography in a Case of Branch Retinal Artery Occlusion

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Abstract

Purpose: We report the variability in flow angiogram during the course of branch retinal artery occlusion (BRAO) in a case imaged by optical coherence tomography angiography (OCTA).
Case Report: OCTA was performed in a patient with BRAO at initial examination and 6 hours later. Initially, the occluded retinal artery and its branches were not detected on OCTA whereas a slow perfusion was present on fluorescein angiography. Six hours after initial examination, flow was detected on OCTA image in the previously occluded artery.
Conclusion: This case confirmed the relevance of using OCTA in monitoring BRAO and showed that capillaries with a very slow flow are not visible on OCTA angiograms. It emphasizes that non-perfusion on OCTA should be interpreted with caution.

Keywords: Optical Coherence Tomography Angiography; Branch; Retinal Artery Occlusion

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INTRODUCTION

Optical coherence tomography angiography (OCTA) is a non-invasive approach for the acquisition of *in vivo* images of the retinal flow structure.[1,2] OCTA allows visualization of the deeper retinal vascular layers and the radial peripapillary network in healthy subjects when compared to visualization using fluorescein angiography (FA).[1,2] It shows retinal capillary perfusion, while FA provides information on the vascular filling speed. However, FA may have side effects and cannot be repeated at close intervals.

This report shows the complementary data provided by OCTA and FA in a case of branch retinal artery occlusion (BRAO), and suggests that the lack of perfusion in OCTA images should be interpreted with caution.

CASE REPORT

A 32-year-old man without any significant medical history presented with a sudden visual field defect in his right eye for two hours. His best-corrected visual acuity at the time was 20/20 in both eyes, and the pupillary reflex and anterior segment were normal.

Fundus examination showed a sectorial area of retinal whitening in the superior part of the posterior pole

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sparing the macula in the right eye. Structural optical coherence tomography (OCT) showed thickening and hyper-reflectivity of the inner retina above the macula on a vertical B-scan. FA confirmed the occlusion of the supero-temporal retinal artery near the optic disc with sparing of an arteriole supplying the macula [Figure 1a]. However, after several minutes, the occluded artery slowly filled with dye from the central retinal artery to the proximal portion, and by a countercurrent flow from adjacent venules to the distal portion [Figure 1b].

The fundus was also imaged using the AngioVue OCTA device (v. 2015.0.1.7, Optovue, Inc., Freemont, CA, USA). Scanning areas were 3 × 3 and 6 × 6 mm. On the initial 6 × 6-mm scan, some flow signal was present at the origin of the (partially) occluded temporal artery near the optic disc, corresponding to the slow filling on FA [Figure 1c]. However, flow was not detected in the superficial or deep capillary plexus (SCP, DCP), in the area of inner retinal whitening [Figures 2a and b]. No flow signal was detected in the macular branches of the occluded artery, but a flow signal was present in the adjacent venules draining the spared macular area [Figures 2a and b].

Six hours after the first examination, the patient reported improvement in his sectorial scotoma and OCTA was repeated. It revealed that flow signal was re-established in the ischemic area [Figures 1d, 2c, 2d] in both the SCP and DCP, and in the branches of the initially occluded artery [Figures 2c and d]. Comparisons of OCT angiograms also showed recovery of the peripapillary capillary perfusion [Figure 1d].

Comprehensive vascular, cardiologic, hematologic, and metabolic workups revealed high homocysteine levels (47 µmol/L; N <15 µmol/L), leading to administration of vitamin supplements.

DISCUSSION

This case report presents the OCTA findings of a patient with acute, labile BRAO. In retinal artery occlusion, the degree of ischemic damage to the retina may vary

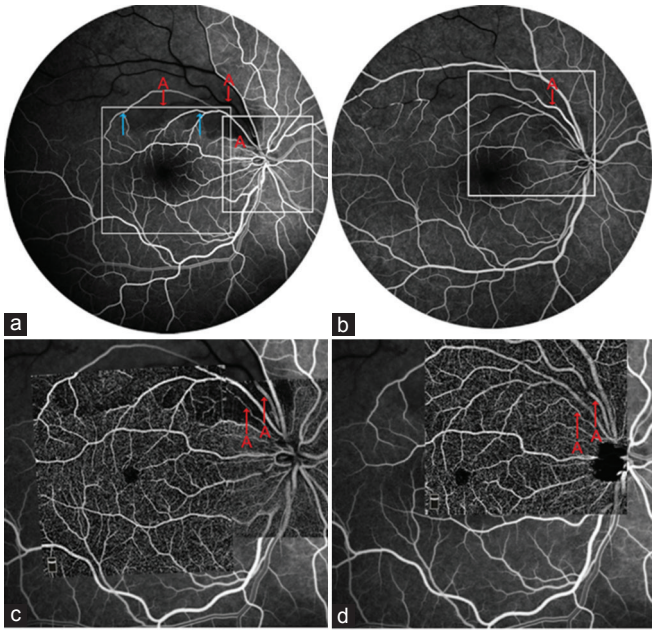

Figure 1. Fluorescein angiography (FA) (a: 25 seconds; b: 1 minute and 12 seconds) and optical coherenct Tomography angiography (OCTA) (6 × 6 mm) images of the superficial capillary plexus at initial examination (c) and 6 hours later (d). Red arrows show arteries and blue arrows show veins. White squares on FA correspond to the OCT angiograms. c: Superimposition of the angiogram and optic disc angiogram at the initial examination: a flow is observed in the supero-temporal artery (upper red arrow) whereas its filling is delayed on FA. The other red arrow shows another small artery with a thin flow. d: Superimposition of angiogram, 6 hours after first examination.

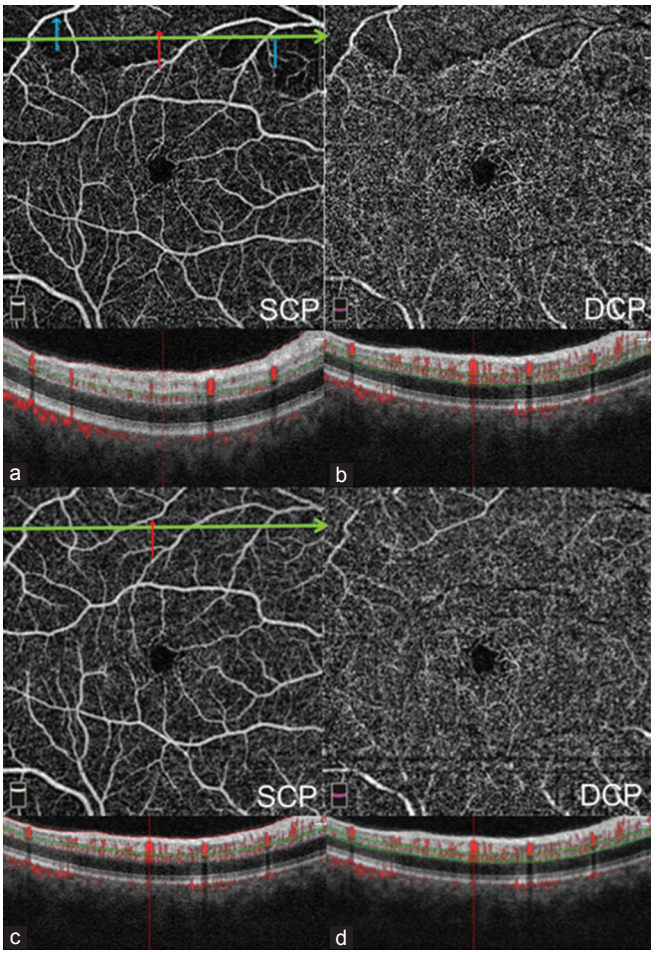

Figure 2. OCTA images (6 × 6 mm) and green lines corresponding to B-scans on initial examination (a and b) and 6 hours later (c and d). a. On the initial superficial capillary plexus (SCP) angiogram, capillaries and arteries (red arrow) are not visible in the occluded area, but venules (blue arrow) are. b. The initial deep capillary plexus (DCP) angiogram shows the absence of flow in the occluded area. c. The SCP angiogram 6 hours later shows the artery (red arrow) and capillaries in the upper part of the occluded area. d. The DCP angiogram 6 hours later shows homogenous capillary flow.

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depending on the duration of vascular obstruction and the degree of blood flow impairment.[3] Various degrees of capillary perfusion have been described on OCTA and correlated with the degree of retinal ischemic damage on structural OCT.[4] In the present case, we observed that initially undetectable arterial and capillary flows on OCTA became visible again 6 hours after the first examination [Figures 1 and 2]. Of note, there were some discrepancies between the initial FA and OCTA findings; a residual flow was visible in some branches of the occluded retinal artery on FA, although no flow was detected on OCTA images. Six hours later, retinal arteries became visible again on OCTA, probably due to an accelerated flow.

This observation gave rise to three remarks. First, the absence of flow on OCTA does not imply a complete absence of perfusion as previously demonstrated,[5] but it does suggest at least a severe reduction in flow to <0.5 mm/s.[6] Indeed, Jia et al[6] first described split-spectrum amplitude decorrelation angiography (SSADA) technique, which has several potential advantages over phase-based techniques, including the ability to quantify microvascular flow. She stated that the SSADA algorithm was able to detect retinal capillary flow ranging between 0.5 and 2 mm/s.[6]

Second, in this case, OCTA recorded the presence of flow in the proximal portion of the occluded artery although no flow signal was present in the distal branches. This could be due to either a very slow flow or complete non-perfusion in the distal arterioles, which made the signal undetectable by OCTA. This area of SCP and DCP non-perfusion corresponded to inner retinal ischemic damage seen on structural OCT.

Finally, OCTA showed complete recovery of the flow signal in the initially occluded retinal artery, all its branches, and the related capillary network. However, as measurement of the flow speed using OCTA is not yet possible, the flow may still be slow despite signal recovery. Advances in OCTA technology will certainly overcome this difficulty in the future.

FA and OCTA provide complementary information. FA provides quantitative information on the filling time of retinal vessels. OCTA provides a detailed view of the retinal microvasculature.[7] Recently, the value of OCTA has been demonstrated for characterization of the extent of macular ischemia and monitoring vascular flow during retinal arterial occlusions.[8,9] This case, in addition to documenting the rapid recovery of a case of BRAO, suggests that when flow is not visible on OCTA angiogram, it may nevertheless be present, although at a very slow speed.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understand that his name and initial will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of Interest

There are no conflicts of interest.

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