

Enhanced Depth Imaging Optical Coherence Tomography A New Method in Diagnosis and Evaluation of Treatment for Choroidal Hemangioma: A Case Report

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Abstract

Purpose: To report the evaluation of the treatment response in choroidal hemangioma with application of enhanced depth imaging optical coherence tomography (EDI-OCT) technique

Case report: A 73-year-old woman with a circumscribed choroidal hemangioma in the posterior pole of her left eye underwent photodynamic therapy and intravitreal injection of bevacizumab. EDI-OCT obtained from the affected eye before and after the treatment. The efficacy of treatment evaluated with indocyanine green and fluorescein angiography (FA).

Results: The EDI-OCT taken before treatment showed increased thickness of choroidal layer as multiple large dark spaces in the outer and middle layers of the choroid. After treatment, EDI-OCT revealed shrinkage of the choroidal thickness (from 712 μm to 273 μm) more pronounced in outer and middle layers.

Conclusion: EDI-OCT may be used as a noninvasive test to help in the diagnosis and evaluation of the treatment response and follow-up of patients with choroidal hemangioma.

Keywords: Choroidal Hemangioma, Enhanced Depth Imaging Optical Coherence Tomography, Photodynamic Therapy

Iranian Journal of Ophthalmology 2010;22(3):47-52 © 2010 by the Iranian Society of Ophthalmology

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Received: March 11, 2010

Accepted: June 10, 2010

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Introduction

Circumscribed choroidal hemangioma appears as a well demarcated amelanotic orange red, dome shaped choroidal tumor that characteristically occurs in the juxtapapillary and macular region of the fundus.¹ Several ancillary tests such as fluorescein angiography (FA), indocyanine green angiography (ICGA) and ultrasonography can help to differentiate this tumor from other simulating tumors. Photodynamic therapy and laser photocoagulation may be used for the treatment of tumor.

FA typically shows hyperfluorescence in the early phase and diffuse intense hyperfluorescence in the late phase.²

ICGA demonstrates a well defined area of intense hyperfluorescence in the early phase, followed by a characteristic dye wash out in the late phase.^{1,3}

B-scan ultrasonography reveals internal acoustic solidity but echogenic character is generally similar to that of the surrounding choroid. On A-scan high internal reflectivity is characteristic.^{2,4}

It is difficult to obtain the full thickness image of the choroid because the pigment in the RPE and choroid impedes visualization by fundus photography and FA.⁵ ICGA can not provide cross sectional imaging of the choroid and B-scan has difficulty in differentiating the retina from the choroid.⁶

Optical coherence tomography (OCT) is used to obtain cross sectional images of the retina but is unable to visualize the choroid in the routine techniques.⁵

Recently a new method, termed enhanced depth imaging optical coherence tomography (EDI-OCT) has been developed that enables to make reliable images of the full thickness of the choroid. It uses a spectral domain OCT positioned close enough to the eye to obtain a stable inverted image at the top of the display. The rationale is that the sensitivity of the imaging in deeper layers is increased.⁵

In this study EDI-OCT was used to evaluate the treatment response and follow-up of a patient with choroidal hemangioma.

Case report

A 73-year-old woman presented to our clinic with a complaint of blurred vision in her left

eye. Medical and drug history was negative. The patient's best corrected visual acuity (BCVA) was $20/32$ in the right eye and $20/50$ in the left eye. Pupils were equal and round and reactive to light. Extraocular motilities were normal in both eyes. Slit-lamp examination showed a mild nuclear cataract in both eyes. Dilated fundusoscopic examination revealed some drusen in the right eye and an elevated subretinal lesion with diameter of two discs nasal to the fovea (near the optic disc). The lesion was fairly pigmented without associated fluid (Figure 1).

A FA obtained after the initial visit showed hyperfluorescence within the lesion. ICGA demonstrated a well defined area of intense hyperfluorescence in the early phases (40 seconds after injection) (Figure 2). FA and ICGA showed marked dye washout in the late phases (20 minutes after injection) (Figure 3).

OCT revealed an elevation of retina, nasal to fovea but the details of the lesion were undetectable in routine techniques (Figure 4). EDI-OCT using Heidelberg spectralis (Heidelberg Engineering, Heidelberg, Germany) was used to evaluate and measure the subretinal lesion. In EDI-OCT we found increased thickness of choroidal level as multiple large irregular dark (hyporeflexive) spaces in the outer and middle layers of the choroid, bulging up anteriorly and pushing the overlying retina inward. The largest diameter of the lesion from the inner border of the choriocapillary to the outer border of the choroid was $712\ \mu\text{m}$ (Figure 5).

The patient underwent photodynamic therapy using verteporfin with dose of $6\ \text{mg}/\text{m}^2$. One month after treatment, BCVA was $20/32$. EDI-OCT revealed the lesion shrinkage more pronounced in the outer and middle layers of the choroid and the lesion thickness decreased to $273\ \mu\text{m}$ at the same point at which the previous scan had been performed (Figure 6).

Eight months after treatment, BCVA was $20/40$. FA and ICGA showed marked decrease in hyperfluorescence with some iso and hypofluorescence areas in early (Figure 7a) and late (Figure 7b) phases.



Figure 1. Fundus photograph shows a pink subretinal elevated mass nasal to the fovea.



Figure 2. In the early phase of fluorescein angiography and indocyanine green angiography, there is hyperfluorescence at the lesion site.

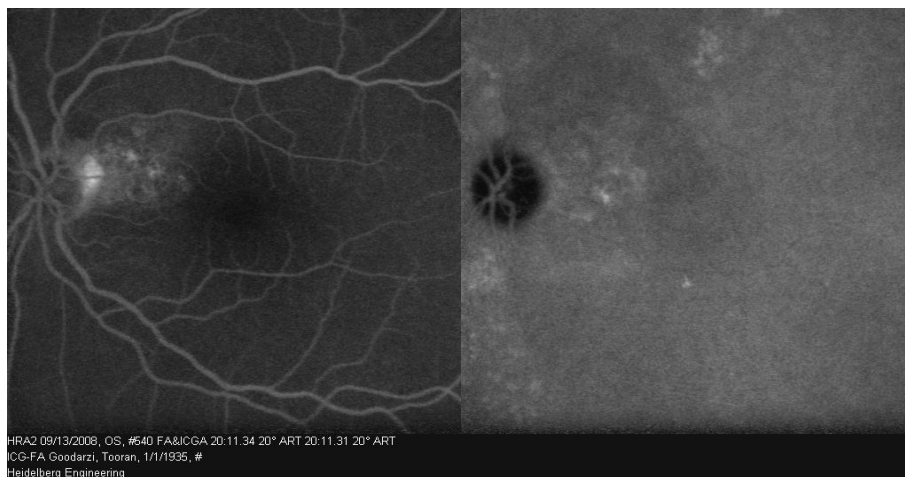


Figure 3. In the late phase of the fluorescein angiography and indocyanine green angiography, there is marked wash out at the site of lesion.

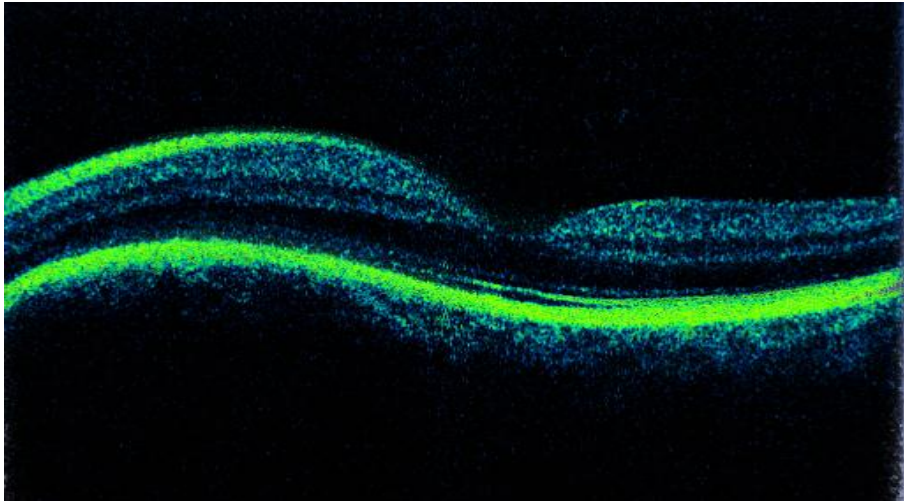


Figure 4. Optical coherence tomography showed an elevation of retina nasal to the fovea.

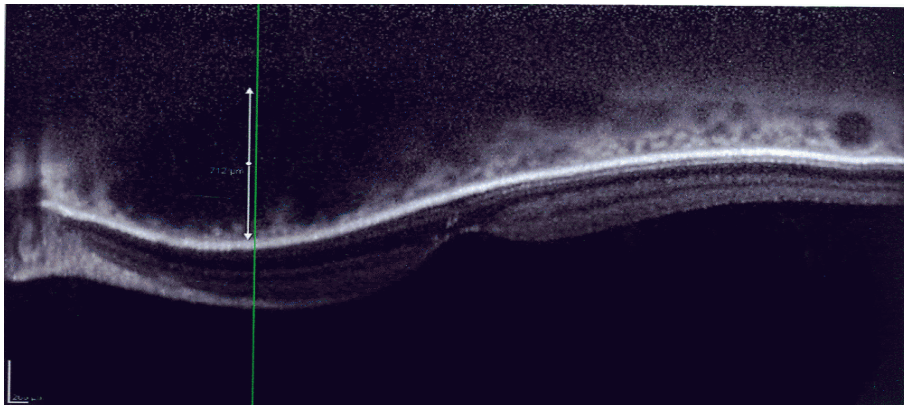


Figure 5. Enhanced depth imaging optical coherence tomography showed the irregular dark spaces nasal to the fovea.

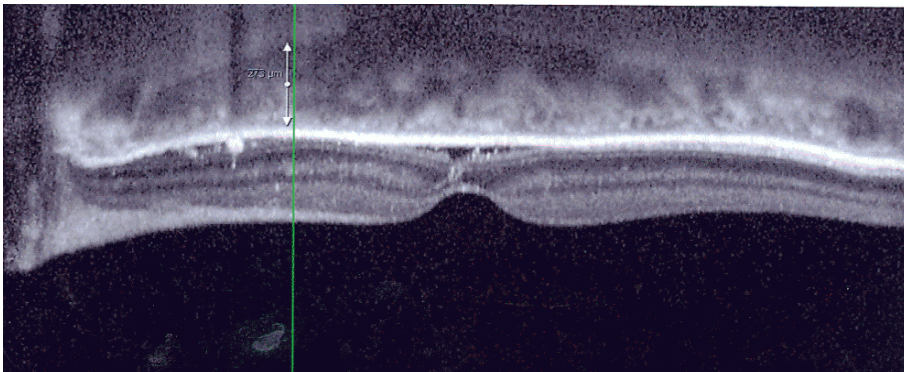


Figure 6. One month after photodynamic therapy, diameter of the same point that had been performed before treatment.

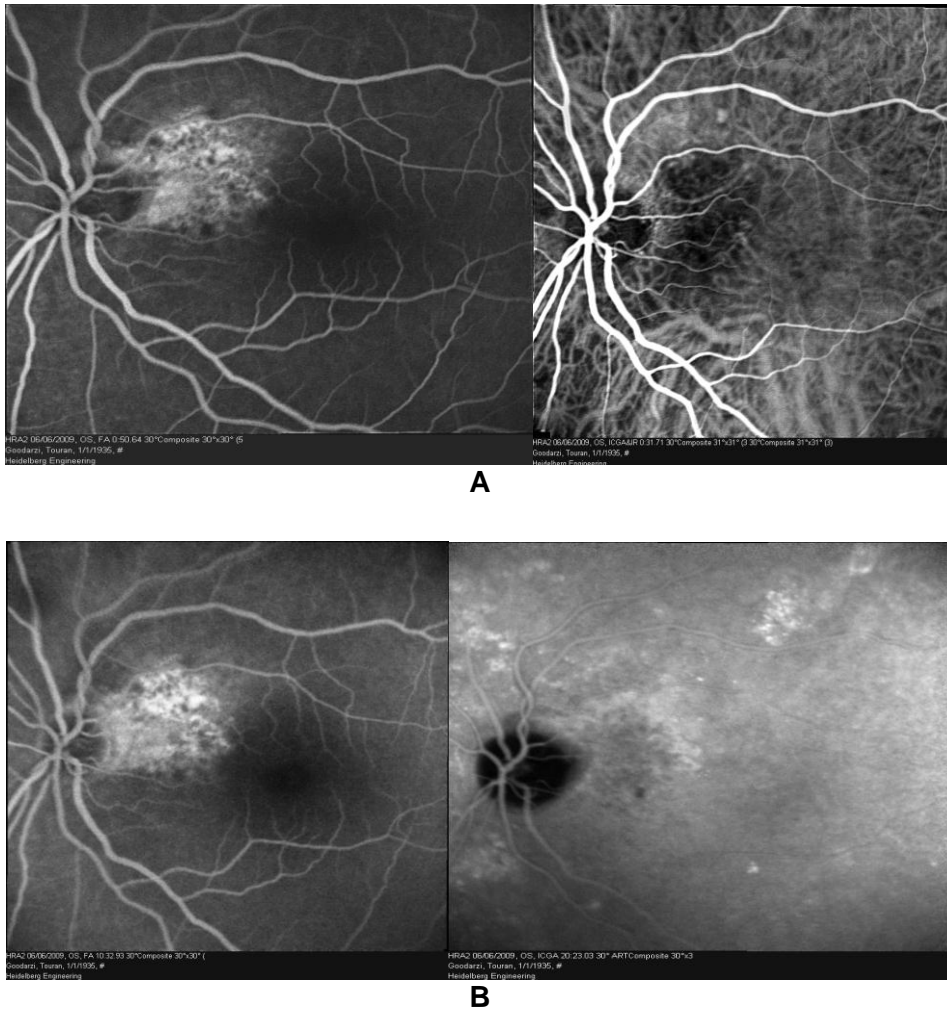


Figure 7. Eight months after photodynamic therapy, in the early and late phases of fluorescein angiography and indocyanine green angiography, there is marked decrease in hyperfluorescence.

Discussion

Conventional spectral-domain OCT devices have a limitation in imaging of the choroid. They use near infrared light that can image the retina and subretinal space, but retinal pigment epithelium and the vascular nature of the choroid scatters the light and deeper penetration is limited.⁵ A new approach to OCT, termed EDI-OCT has been used for imaging the full thickness of the choroid. The choroid was imaged by positioning the OCT instrument close enough to the eye to obtain an inverted image.⁵

Margolis and Spaide used the EDI-OCT for evaluating the choroid in normal eyes. They reported that horizontal section centered on the fovea, the choroidal thickness was

greatest at the fovea and decreased rapidly in the nasal direction. The choroidal thickness at all measured points were correlated inversely with age.⁷

Spaide showed that EDI-OCT can describe the internal structure of pigment epithelial detachment (PED) in age-related macular degeneration (AMD). The study found that PEDs abutting the undersurface of the RPE may represent neovascularization. Also, they used OCT for describing the PED, but in the conventional OCT, PED appears to be optically empty. They found that EDI-OCT could be used to examine PED associated with AMD to learn more about their internal structure.⁸

Fujiwara et al used EDI-OCT for measurement of macular choroidal thickness in highly myopic eyes. They found that the choroidal thickness was greatest at the fovea and decreased more nasally than temporally. EDI-OCT demonstrated that high myopic eyes have thin choroid. Also, they showed that age-related rate of choroidal thinning in myopic eyes is similar to normal eyes.⁹

Conclusion

The present study found that EDI-OCT may be used as a noninvasive test to help in the diagnosis and evaluate the treatment response and follow-up of patients with choroidal hemangioma. It is easy to obtain detailed images of the choroid without the

need for pupillary dilation. It is possible to measure accurate diameter of the lesion at different points and exactly show the internal structure of various lesions in the choroid including choroidal hemangioma. On the other hand, it should be noted that there are some limitations for EDI-OCT imaging of the choroidal lesions. Some of the pathologies anterior to the choroidal lesions such as hemorrhage, exudate and PED could obscure the image by shadowing over them. Taking this method of imaging is more difficult and needs more expertise than ordinary OCT. It is recommended to use EDI-OCT in larger scales for different pathologies in the choroid to increase our knowledge about its limitations and possible artifacts.

References

1. Anand R, Augsburger JJ, Shields JA. Circumscribed choroidal hemangioma. *Arch Ophthalmol* 1989;107(9):1338-42.
2. Shields CL, Honavar SG, Shields JA, et al. Circumscribed choroidal hemangioma: clinical manifestations and factors predictive of visual outcome in 200 consecutive cases. *Ophthalmology* 2001;108(12):2237-48.
3. Witschel H, Font RL. Hemangioma of the choroid, A clinicopathologic study of 71 cases and a review of the literature. *Surv Ophthalmol* 1976;20(6):415-31.
4. Verbeek AM, Koutentakis P, Deutman AF. Circumscribed choroidal hemangioma diagnosed by ultrasonography. A retrospective analysis of 40 cases. *Int Ophthalmol* 1995-1996;19(3):185-9.
5. Spaide RF, Koizumi H, Pozzoni MC. Enhanced depth imaging spectral-domain optical coherence tomography. *Am J Ophthalmol* 2008;146(4):496-500.
6. Coleman DJ, Silverman RH, Chabi A, et al. High-resolution ultrasonic imaging of the posterior segment. *Ophthalmology* 2004;111(7):1344-51.
7. Margolis R, Spaide RF. A pilot study of enhanced depth imaging optical coherence tomography of the choroid in normal eyes. *Am J Ophthalmol* 2009;147(5):811-5.
8. Spaide RF. Enhanced depth imaging optical coherence tomography of retinal pigment epithelial detachment in age-related macular degeneration. *Am J Ophthalmol* 2009;147(4):644-52.
9. Fujiwara T, Imamura Y, Margolis R, et al. Enhanced depth imaging optical coherence tomography of the choroid in highly myopic eyes. *Am J Ophthalmol* 2009;148(3):445-50.