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Original research

Choroidal thickness in idiopathic macular hole

Reza Karkhaneh, Masoud Nikbakht, Fatemeh Bazvand, Afshin Kalantary Oskouei, Hamed Ghasemi, Fariba Ghassemi*

Eye Research Center, Farabi Eye Hospital, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

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Abstract

Purpose: To measure the submacular choroidal thickness in eyes with idiopathic macular hole (IMH) compared with unaffected fellow eyes and normal control eyes.
Methods: In this single institutional retrospective comparative case-control study, 34 consecutive patients with IMH were included and compared with 30 normal age- and sex-matched eyes that were planned to have cataract surgery. The included eyes were divided into 4 groups: 41 eyes with IMH (A), 23 unaffected fellow eyes (B), 30 normal eyes (C), and 12 vitrectomized IMH eyes (D).
Results: The choroidal thickness was significantly lower in all measured points in IMH eyes versus normal control eyes (subfoveal choroidal thickness [SFCT]: 215.76 ± 66.7 vs. 288.53 ± 72.0, $P < 0.001$) and at most locations in comparison between group B and C (SFCT: 231.79 ± 68.6 vs. 288.53 ± 72.0, $P = 0.018$). No significant difference was found in choroidal thickness between both eyes of patients with unilateral IMH ($P = 0.81$). The choroidal thickness was not altered after vitrectomy in the mean 6 months follow-up period. A negative correlation between the apical diameter and SFCT ($P = 0.05$) (P value of 0.034 and 0.05) and best-corrected visual acuity and apical and basal diameter ($P = 0.006$ and $P = 0.029$, respectively) was observed.
Conclusion: Choroidal thickness is reduced in both eyes of patients with IMH compared with normal age- and sex-matched control eyes.

Keywords: Choroidal thickness; Idiopathic macular hole; Macular hole

Introduction

Idiopathic macular hole (IMH), as the most common type of macular hole, is characterized by full-thickness anatomic defect at the fovea, leading to loss of central vision.[1–3] Although it is generally accepted that IMH is caused by vitreofoveal traction,[4,5] other factors including degeneration of macular cyst, involutional macular thinning, pigment epithelium disease, hormonal influences, and systemic vascular disorders may be involved in its pathogenesis.[4,6,7] Recently, choroidal thinning in IMH was noted.[8–15] It is suggested that choroidal hypoperfusion plays a role in the macular thinning as a theoretical pathogenic factor causing IMHs.

The quantitative measurement of choroidal thickness is possible by using enhanced depth optical coherence tomography (EDI OCT). Recently, some studies found that patients with IMH have a reduced choroidal thickness, both in the affected and in the unaffected fellow eye, using EDI OCT.[8–10] It is hypothesized that the choroidal thinning may be an indicator of reduction in perfusion of foveal avascular zone and plays some roles in the creation or progression of IMH.[7,11]

In this study, we evaluated the choroidal thickness of patients with IMH and compared them with unaffected fellow eyes and healthy age- and gender-matched healthy control eyes.

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* Corresponding author. Eye Research Center, Farabi Eye Hospital, Qazvin Square, Tehran, 1336616351, Islamic Republic of Iran.
E-mail addresses: ghasemi_f@sina.tums.ac.ir, fariba.ghassemi@gmail.com (F. Ghassemi).
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Methods

This retrospective case-control comparative study was performed from 2012 to 2014. Institutional Review Board approval was obtained. Tenets of the Helsinki Declaration were followed. Staging of the macular hole was performed biomicroscopically with a slit lamp examination according to the Gass classification[9] and by OCT examination.[5] Consecutive patients examined at our retina clinic with a full-thickness (stage 2, 3, or 4) IMH in one eye and an unaffected fellow eye were recruited. For each patient with macular hole (MH), each consecutive healthy subject with the same age and sex who fulfilled the inclusion and exclusion criteria was enrolled in the control group.

Patients with systemic disorders (diabetes mellitus and hypertension), high refractive errors (spherical equivalent beyond −3 and +3 diopters), axial lengths more than 24 and less than 22, amblyopia, any history of other ocular disease and operation, and patients with poor quality images were excluded. The images were obtained with the best visualization of the border between the choroid and the sclera known as the choroidal−scleral interface (CSI). If neither image had a clearly identifiable CSI, the patient was excluded. Thirty-four consecutive patients with unilateral or bilateral idiopathic macular hole (IMH) and 30 age- and gender-matched healthy subjects (as the control group) were included in this study. Complete ophthalmic examination and axial length measurement were performed for all subjects by an optical instrument (IOL Master, Zeis IOL master 500, Germany). The visual acuity (best corrected visual acuity [BCVA]) was measured by Snellen chart and transformed to LogMAR.

Choroidal thickness was measured on EDI OCT images obtained by Heidelberg Spectralis OCT (Heidelberg Engineering, Heidelberg, Germany). The EDI image was averaged over 100 scans using the automatic averaging and eye tracking system. Five to seven sections, each comprising 100 averaged scans, were obtained in a 5 × 15-degree rectangle encompassing the macula, and the horizontal section directly crossing the center of the fovea was selected. All measurements were performed manually using Image J software version 1.45S (National Institutes of Health, Bethesda, Maryland, USA). B-scans were directly exported from the OCT machine and read into ImageJ software for processing. The choroidal thickness measurements were measured in micrometer and documented separately by two independent graders. The measurements were averaged for analysis. The distance between the outer portion of the hyper-reflective line of retinal pigment epithelium (RPE)-Bruch's membrane complex and the inner surface of choroid-scleral junction was measured. The choroidal thickness was measured at 7 points; at subfoveal choroidal thickness (SFCT), 0.5 mm, 1 mm and 2 mm nasally (N0.5, N1 and N2), and temporally (T0.5, T1 and T2) from foveal center (Fig. 1). Two diameters of the MH were measured as described by Ullrich et al,[3] with the apical diameter being the minimum distance at the neurosensory retinal defect, and the basal diameter being the distance at the base of the hole at the level of the RPE.

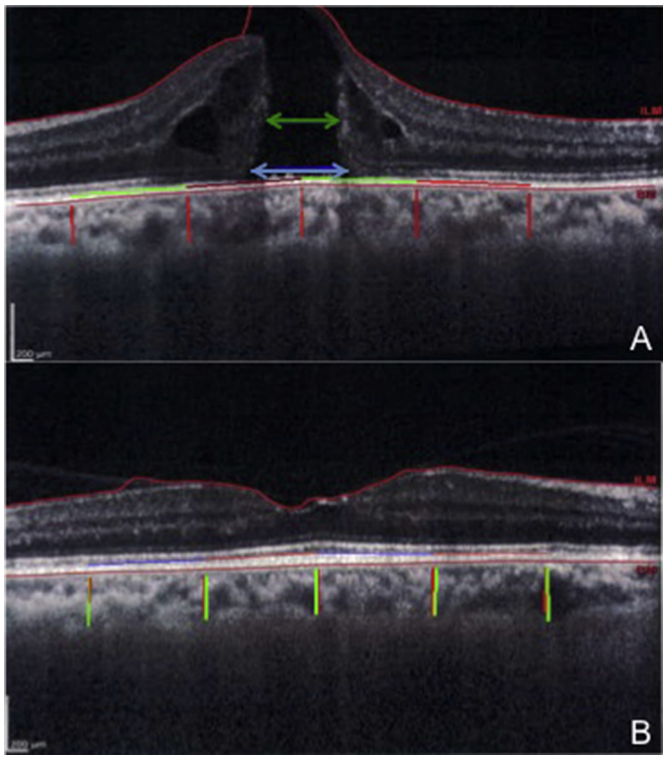

Fig. 1. A. Measurement of choroidal thickness at the fovea and 1 mm and 2 mm away from the fovea in the nasal and temporal directions. The green line refers to the apical diameter of the macular hole, and the blue line refers to the basal macular hole. B. The measurement of choroidal thicknesses at the fovea, 1 mm, and 2 mm from the foveal center in the contralateral eye of the same patient.

The height was measured as the highest perpendicular line from apical diameter line to RPE-Bruch complex, respectively. Four groups were defined in this study. The affected eyes were with IMH (group A), the normal fellow eyes of patients (group B), the normal eyes of healthy subjects as control samples (group C), and the same eyes after surgery (group D).

Statistical analysis

Statistical analysis was performed using a SPSS software, version 16.0 (SPSS, Inc, Chicago, IL). The data was analyzed descriptively (Mean ± SD). The assessment distribution was performed by Shapiro−Wilk test. Because of the small sample size, the Kruskal−Wallis nonparametric test was used for comparison between all four groups. The independent sample t-test was used for the comparison between choroidal thicknesses in the groups. Paired t-test and Chi-square test were used for other variables and comparison. With this number of variables, the P value was adjusted using the Bonferroni correction for finding the true significant differences.[15] The correlations between choroidal thickness and age, gender, axial length, diameters and height of the hole and BCVA, and diameter and height of the hole were assessed by Pearson correlation coefficient and approved by linear regression. P value less than 0.05 was considered significant.

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