Original Article

Early Macular Changes after Phacoemulsification in Eyes with High Myopia

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Abstract

Purpose: To evaluate macular changes after cataract surgery in eyes with high myopia.
Methods: This prospective cohort enrolled patients with high myopia (axial length ≥26 mm) who underwent phacoemulsification with intraocular lens implantation. Spectral-domain optical coherence tomography (OCT) scans were obtained at baseline and 2 and 6 months after the operation. Postoperative macular changes on OCT scans were regarded as the main outcome measure.
Results: Thirty-four eyes of 31 patients with high myopia were included (age, 60 ± 10 years [mean ± SD]); of these, 14 patients (45.2%) were male. The mean axial length was 27.8 ± 1.5 mm. Epiretinal membrane (one eye, 2.9%), lamellar hole (one eye, 2.9%), myopic foveoschisis (2 eyes, 5.9%), and vitreomacular traction associated with foveoschisis (one eye, 2.9%) were notable findings at baseline examination; no eye showed cystoid macular edema (CME) at this time. At the 2-month examination, three eyes (8.8%) developed CME. At the 6-month follow-up, one eye with CME at 2 months improved, and a new case of CME (5.6%) was detected. The characteristics of epiretinal membrane, lamellar hole, vitreomacular traction, and foveoschisis did not change at the 2- and 6-month examinations and no new cases occurred.
Conclusion: Uncomplicated phacoemulsification had no significant effect on the prevalence or characteristics of pre-existing macular abnormalities in eyes with high myopia up to 6 months of follow-up. The incidence of CME 2 months after uncomplicated cataract surgery in eyes with high myopia was about 9%.

Keywords: Cystoid Macular Edema; Epiretinal Membrane; Macular Hole; Myopia; Optical Coherence Tomography; Schisis; Vitreomacular Traction

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INTRODUCTION

Myopia is a relatively common ocular disorder. The prevalence of high myopia in the population has been estimated to be approximately 0.5% to 1%.[1,2] Pathologic myopia is one of the leading causes of irreversible visual impairment worldwide, particularly in younger individuals.[3-5] Myopic eyes show various changes in ocular structures, including the cornea, lens, and most dramatically, the posterior segment.[6] Actually, highly myopic eyes are not simply elongated, but rather show areas of out-pouching, especially in the posterior pole.[7] These morphological changes are probably the underlying causes for the characteristic findings of

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myopic maculopathy, such as staphylomata, Fuchs' spots, lacquer cracks, and chorioretinal atrophy.[6,8,9] The incidence of myopic maculopathy increases with age, suggesting a progressive clinical course.[9,10]

With the advent of optical coherence tomography (OCT), and spectral-domain OCT (SD-OCT) in particular, more subtle changes in the myopic macula have been identified. This modality is exceedingly helpful in diagnosing and differentiating macular pathologies such as epiretinal membranes, full-thickness or lamellar holes, cystoid macular edema (CME), myopic foveoschisis, and dome-shaped macula.[11,12] The retest function of some OCT devices allows clinicians to obtain follow-up scans from exactly the same area of the macula, which helps in tracking even minimal alterations in macular configuration.[13]

Phacoemulsification is associated with an increased rate of posterior vitreous detachment (PVD) in the postoperative period.[14,15] Several myopic macular pathologies such as macular holes or foveoschisis are believed to be the result of anomalous vitreomacular forces. Theoretically, phacoemulsification, by inducing premature PVD, may cause or accelerate the progression of myopic macular pathologies.

While macular changes in eyes with high myopia have been extensively studied, myopic macular changes after cataract surgery have not been widely investigated. The purpose of the present study was to evaluate and report postoperative macular changes in eyes with high myopia, as determined by SD-OCT.

METHODS

Study Population

In this prospective observational case series, 34 eyes of 31 patients with high myopia (axial length ≥26 mm) who were scheduled to undergo cataract surgery between October 2012 and September 2014 were enrolled. Participants did not have any eye disorders except for myopia and cataract. A comprehensive ocular examination, including measurement of visual acuity, slit-lamp biomicroscopy, and fundus exam using a 90-diopter noncontact lens, was performed on each eye. Patients with a positive history (or objective signs) of ocular disorders (such as glaucoma, diabetic retinopathy, retinal vascular occlusion, choroidal neovascularization, and uveitis), previous trauma or ocular surgery, any intra- or postoperative complications (such as vitreous loss, suprachoroidal hemorrhage, and endophthalmitis), or inability to cooperate during OCT measurements were excluded. Informed consent was obtained from all participants at the time of enrolment. The study protocol adhered to the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of Shiraz University of Medical Sciences.

Measurements

Patients underwent complete ocular examination before the operation and at regular intervals after the operation (1 day, 1 week, and 1, 2, and 6 months). Axial length and biometry were measured by IOL Master 500 (Carl Zeiss Meditec Inc., Dublin, CA, USA) before the operation.

OCT images were obtained with Spectralis SD-OCT (Heidelberg Engineering GmbH, Heidelberg, Germany) using the retest function at baseline and at 2 and 6 months after the operation. OCT images were retrieved from four radial scan lines, centered at the fixation point, at angles of 0°, 45°, 90°, and 135°. Each line encompassed 20° of the corresponding retina. At the conclusion of the study, all OCT scans were independently reviewed by two vitreoretinal specialists (HA and MHN), and any significant macular finding was recorded. OCT images were evaluated qualitatively to detect and differentiate distinct myopic macular changes such as vitreomacular traction, full-thickness or lamellar holes, epiretinal membranes, foveoschisis, CME, and choroidal neovascularization. Pseudophakic CME was defined by the emergence of new postoperative macular extracellular cystic spaces in SD-OCT images. Pseudophakic CME was classified as mild or clinically relevant CME (<40% or ≥40% increase from baseline central point thickness, respectively).[16] Follow-up scans were compared with previous images to detect subtle changes. Discrepancies between the assessments by the two investigators were resolved through mutual discussion.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics software version 21 (SPSS Inc., Chicago, IL). Descriptive statistical results were reported as the percentage of prevalence for macular pathologies at each time point.

RESULTS

The mean (±SD) age of the patients was 60 ± 10 years (range, 45 to 84 years), and 14 patients (45%) were male. The mean axial length was 27.8 ± 1.5 mm (range, 26.0 to 31.4 mm). All 34 eyes underwent the baseline and 2-month evaluations, but only 18 eyes underwent the final examination at 6 months. The causes of loss to follow-up were as follows: one patient died; one patient became bedridden due to hip fracture; and the remaining patients either did not respond to follow-up phone calls or did not consent for further evaluation.

No patient had CME at baseline. Three eyes out of 34 (8.8%) developed CME at 2 months, and one eye

out of 18 (5.6%) developed new CME at 6 months [Tables 1 and 2]. Before the operation, one eye (2.9%) had an epiretinal membrane, one (2.9%) had a lamellar hole, two (5.9%) had myopic foveoschisis, and one (2.9%) had vitreomacular traction with associated foveoschisis. There was no significant change in the rate or severity of the mentioned macular changes 2 months after the operation. Among eyes with macular pathologies other than CME, only one with a lamellar hole presented for examination at 6 months and showed no considerable alterations in OCT images. Excluding CME, no new cases of macular pathology were observed in the remaining 17 eyes over the complete follow-up period.

Unfortunately, we did not record the state of PVD at the outset of the study. However, we retrospectively reviewed the preoperative and available postoperative OCT images, and found evidence of vitreomacular or vitreous-to-disc adhesions (evidence against PVD) in 9 (36%) eyes. The PVD-related findings did not change at 2 and 6 months after the operation.

DISCUSSION

In the present study, we evaluated the incidence and evolution of macular pathologies after cataract surgery in patients with high myopia. The topic seems plausible because macular pathologies are more common in myopic eyes, and cataract surgery has been associated with postoperative inflammation and premature PVD, both of which may induce maculopathy.[17] Therefore, we conducted this preliminary study to find out whether cataract surgery has a notable impact on macular pathologies in eyes with high myopia.

In this study, macular pathologies (except CME) were found in five eyes (14.7%) at baseline. At the 2-month postoperative examination, the prevalence did not increase, and the eyes with previous abnormalities did not show any alterations in OCT. Unfortunately, only one out of the five eyes with macular abnormalities underwent the 6-month follow-up examination. This eye showed no significant change in OCT findings. Overall, the results of the present study do not provide any evidence for macular changes (other than development of CME) during the early postoperative period. Although the sample size was relatively small, the study suggests that the incidence or evolution of postoperative macular pathologies in eyes with high myopia is probably low, and hence, does not have notable clinical relevance.

Table 1. Incidence of CME in 34 myopic eyes at 2 months after phacoemulsification

	CME, *n* (%)		
	No	Mild	Clinically relevant
Baseline	34 (100%)	0 (0%)	0 (0%)
2 months	31 (91.2%)	1 (2.9%)	2 (5.9%)

CME, cystoid macular edema.

Table 2. Incidence of CME in 18 myopic eyes at 2 and 6 months after phacoemulsification

	CME, *n* (%)		
	No	Mild	Clinically relevant
Baseline	18 (100%)	0 (0%)	0 (0%)
2 months	17 (94.4%)	0 (0%)	1 (5.6%)†
6 months	17 (94.4%)	1 (5.6%)‡	0 (0%)

CME, cystoid macular edemac †The edema in this case was resolved at 6 months. ‡This case showed no edema at the 2-month examination.

Postoperative inflammation and premature PVD, the two major culprits for postoperative macular changes, occur mostly during the first month after surgery. Mirshahi et al[15] reported that 30 out of 34 (88%) post-phacoemulsification PVDs occurred during the first month after surgery, and only four eyes developed PVD thereafter until 1 year of follow-up. Similarly, postoperative inflammation typically occurs within the first few weeks after the operation, which could be suppressed by appropriate perioperative topical medications.[17] Thus, the follow-up period of 2 months, which was applicable for all cases in the current study, should have detected most related macular pathologies. However, late-onset changes from insidious mechanisms or additional interventions, such as Nd: YAG laser posterior capsulotomy, are likely to occur and should be evaluated in future studies.

The incidence of postoperative CME at 2 months in the current study was 8.8% (3 eyes). Kusbeci et al[18] evaluated postoperative CME by OCT in 91 normal eyes that underwent uncomplicated phacoemulsification, and found an incidence of 5.5% at 12 weeks. Although because of small sample sizes of these studies, their results may not be generalized, highly myopic eyes seem to have a comparable incidence of postoperative CME to those without pathologic myopia.[19]

Notable strengths of the present study are its prospective nature and the use of the precise retest function of SD-OCT for evaluating macular changes. Major limitations of the current study are the small sample size and the numerous cases lost to follow-up at 6 months. However, considering the relative rarity of eyes with high myopia, the findings of this study are of value as a preliminary investigation.

In conclusion, the outcomes of the present study suggest that phacoemulsification has no clinically relevant detrimental impact on the incidence or evolution of macular pathologies in eyes with high myopia. Moreover, the incidence of CME in these eyes seems to be not considerably different from that in normal eyes. Future studies with larger sample sizes and longer follow-up periods are warranted to determine the exact postoperative incidence of macular disorders in eyes with high myopia.

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Conflicts of Interest

There are no conflicts of interest.

REFERENCES

1. Nangia V, Jonas JB, Sinha A, Matin A, Kulkarni M, Panda-Jonas S. Ocular axial length and its associations in an adult population of central rural India: The Central India Eye and Medical Study. *Ophthalmology* 2010;117:1360-1366.
2. Yin G, Wang YX, Zheng ZY, Yang H, Xu L, Jonas JB. Ocular axial length and its associations in Chinese: The Beijing Eye Study. *PLoS One* 2012;7:e43172.
3. Xu L, Wang Y, Li Y, Cui T, Li J, Jonas JB. Causes of blindness and visual impairment in urban and rural areas in Beijing: The Beijing Eye Study. *Ophthalmology* 2006;113:1134e1-11.
4. Liang YB, Friedman DS, Wong TY, Zhan SY, Sun LP, Wang JJ, et al. Prevalence and causes of low vision and blindness in a rural Chinese adult population: The Handan Eye Study. *Ophthalmology* 2008;115:1965-1972.
5. Hsu WM, Cheng CY, Liu JH, Tsai SY, Chou P. Prevalence and causes of visual impairment in an elderly Chinese population in Taiwan: The Shihpai Eye Study. *Ophthalmology* 2004;111:62-69.
6. Curtin BJ. The posterior staphyloma of pathologic myopia. *Trans Am Ophthalmol Soc* 1977;75:67-86.
7. Moriyama M, Ohno-Matsui K, Hayashi K, Shimada N, Yoshida T, Tokoro T, et al. Topographic analyses of shape of eyes with pathologic myopia by high-resolution three-dimensional magnetic resonance imaging. *Ophthalmology* 2011;118:1626-1637.
8. Steidl SM, Pruett RC. Macular complications associated with posterior staphyloma. *Am J Ophthalmol* 1997;123:181-187.
9. Vongphanit J, Mitchell P, Wang JJ. Prevalence and progression of myopic retinopathy in an older population. *Ophthalmology* 2002;109:704-711.
10. Liu HH, Xu L, Wang YX, Wang S, You QS, Jonas JB. Prevalence and progression of myopic retinopathy in Chinese adults: The Beijing Eye Study. *Ophthalmology* 2010;117:1763-1768.
11. Ellabban AA, Tsujikawa A, Muraoka Y, Yamashiro K, Oishi A, Ooto S, et al. Dome-shaped macular configuration: Longitudinal changes in the sclera and choroid by swept-source optical coherence tomography over two years. *Am J Ophthalmol* 2014;158:1062-1070.
12. Gohil R, Sivaprasad S, Han LT, Mathew R, Kiousis G, Yang Y. Myopic foveoschisis: A clinical review. *Eye (Lond)* 2015;29:593-601.
13. Ashraf H, Nowroozzadeh MH. Diurnal variation of retinal thickness in healthy subjects. *Optom Vis Sci* 2014;91:615-623.
14. Hilford D, Hilford M, Mathew A, Polkinghorne PJ. Posterior vitreous detachment following cataract surgery. *Eye (Lond)* 2009;23:1388-1392.
15. Mirshahi A, Hoehn F, Lorenz K, Hattenbach LO. Incidence of posterior vitreous detachment after cataract surgery. *J Cataract Refract Surg* 2009;35:987-991.
16. Kim SJ, Belair ML, Bressler NM, Dunn JP, Thorne JE, Kedhar SR, et al. A method of reporting macular edema after cataract surgery using optical coherence tomography. *Retina* 2008;28:870-876.
17. Kessel L, Tendal B, Jørgensen KJ, Erngaard D, Flesner P, Andresen JL, et al. Post-cataract prevention of inflammation and macular edema by steroid and nonsteroidal anti-inflammatory eye drops: A systematic review. *Ophthalmology* 2014;121:1915-1924.
18. Kusbeci T, Eryigit L, Yavas G, Inan UU. Evaluation of cystoid macular edema using optical coherence tomography and fundus fluorescein angiography after uncomplicated phacoemulsification surgery. *Curr Eye Res* 2012;37:327-333.
19. Chu CJ, Johnston RL, Buscombe C, Sallam AB, Mohamed Q, Yang YC, et al. Risk factors and incidence of macular edema after cataract surgery: A database study of 81984 eyes. *Ophthalmology* 2016;123:316-323.