

The Determination of Macular Diseases with the Preoperative Optical Coherence Tomography in Patients Undergoing Cataract Surgery

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ABSTRACT

Purpose: To determine subclinical macular pathologies in patients undergoing cataract surgery with optical coherence tomography (OCT)

Materials and Methods: The files of cases who underwent cataract surgery between July 2020 and December 2023 were examined. The eyes included in the study were those with no pathology determined in fundus examination, with no history of macular disease, and with adequate quality images obtained on OCT. The eyes were separated into two groups as those with and without pathology on OCT. The relationships between the prevalence of macular pathologies and potential risk factors were analyzed.

Results: Evaluation was made of 705 eyes of 508 patients. Macular pathology was determined on the preoperative OCT in 79 (11.2%) patients. The most frequently seen pathologies were epiretinal membrane (29 eyes, 36.7%), age-related macular degeneration (23 eyes, 29.1%), and vitreomacular traction (9 eyes, 11.4%). The mean age of the cases determined with pathology was seen to be statistically significantly higher than that of the cases without pathology ($p<0.001$). No significant difference was determined between the two groups in respect of gender, preoperative visual acuity, and systemic diseases.

Conclusion: In patients who are planned to cataract surgery, OCT is more sensitive than biomicroscopic fundus examination in the determination of macular pathologies. The preoperative determination of macular pathologies is important in terms of predicting visual outcomes, informing the patient of potential postoperative risks, and in deciding the type of lens to be used. Therefore, preoperative macular OCT should be added to the routine examination methods.

Keywords: Cataract, Maculopathy, Optical coherence tomography

INTRODUCTION

Cataract is the leading cause of treatable sight loss in adult patients.¹ Phacoemulsification and intraocular lens (IOL) implantation is the most frequently applied surgical treatment technique. Although surgery is usually performed without complications, postoperative high refractive error and other accompanying eye pathologies, especially macular pathologies, have a negative effect on the visual prognosis. With advances in surgical techniques and the development of different types of IOL (multifocal, toric), postoperative refractive error can now be reduced to a min-

imum. However, the macula should be healthy to obtain satisfactory results with multifocal lenses.² Thus, in cases planned to undergo routine cataract surgery, the preoperative determination of macular pathologies is important in making the decision for surgery, estimating the postoperative visual level, and determining the frequency of follow up.³

Biomicroscopic fundus examination is the basic diagnostic method to detect macular pathologies in cataract patients. However, some retinal and vitreoretinal interface patholo-

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gies may not be seen in fundus examination and insufficient dilatation of the pupil and cataract itself that can affect the vision, can cause insufficient evaluation of the fundus.⁴ In situations such as these, the sensitivity of spectral domain optical coherence tomography (OCT) is higher in showing macular pathologies.⁵

The aim of this study was to determine macular pathologies through evaluations with OCT of patients with a normal preoperative fundus examination who underwent cataract surgery and to evaluate the potential risk factors for macular pathologies.

MATERIALS AND METHODS

A retrospective examination was made on the files of patients who underwent phacoemulsification and IOL implantation in the Ophthalmology Clinic of Elazığ Fethi Sekin City Hospital between July 2020 and December 2023. Approval for the study was granted by the Ethics Committee of Firat University (2024/03-47). As the study was retrospective, written informed consent was not required.

Of the patients who underwent phacoemulsification, only those with a normal preoperative biomicroscopic fundus examination were included in the study. Cases were excluded if the fundus could not be clearly differentiated because of opacities in the medium, if they had a known history of retinal disease, if a macular pathology was determined in the biomicroscopic examination, or if an OCT image of sufficient quality for evaluation could not be obtained. A record was made for each patient of demographic characteristics and systemic diseases present (hypertension, diabetes mellitus, coronary artery disease, chronic obstructive pulmonary disease). Systemic diseases were determined based on the anamnesis and examination of hospital records.

All the patients underwent a detailed ophthalmological examination preoperatively. Best corrected visual acuity was examined using a Snellen chart. Intra-ocular pressure was measured with Goldmann applanation tonometry. The cataract type was determined and the fundus examination was performed following pupil dilatation. Then, spectral

domain macular OCT (OCT HS100, Canon, Australia) was performed. The patients were separated into two groups according to the OCT findings as normal OCT and pathological OCT. The relationship was evaluated between macular pathologies and age, gender, systemic diseases, and preoperative visual acuity.

Statistical Analysis

Data obtained in the study were analyzed using SPSS vn. 22.0 software. Descriptive statistics were stated as mean \pm standard deviation values for continuous variables and as number (n) and percentage (%) for categorical data. The Chi-square test was used in the analysis of categorical data. Conformity of the continuous data to normal distribution was assessed with the Kolmogorov-Smirnov test, and the Mann Whitney U-test was applied as normal distribution was not observed. A value of $p < 0.05$ was accepted as statistically significant.

RESULTS

Evaluation was made of 705 eyes of 508 patients. The demographic and clinical characteristics of the patients at the time of presentation are shown in Table 1. Pathology was determined in 79 (11.2%) eyes on the preoperative OCT. The pathologies determined were epiretinal membrane (ERM) in 29 (36.7%) eyes, dry type age-related macular degeneration (AMD) in 23 (29.1%), vitreomacular traction (VMT) in 9 (11.4%), retina outer segment defect in 5 (6.3%), subfoveal drusenoid deposit in 5 (6.3%), subfoveal fluid due to central serous chorioretinopathy in 3 (3.8%) and branch retinal vein occlusion in 2 (2.5%), foveal edema due to diabetes in 2 (2.5%), and retinal thinning due to a previous vein branch obstruction in 1 (1.3%). The most frequently seen macular pathologies are shown in Figure 1.

The mean age of the cases determined with pathology on OCT was seen to be statistically significantly higher than that of the cases without pathology ($p < 0.001$). No significant difference was determined between the two groups in respect of gender, preoperative visual acuity, and systemic diseases (Table 2).

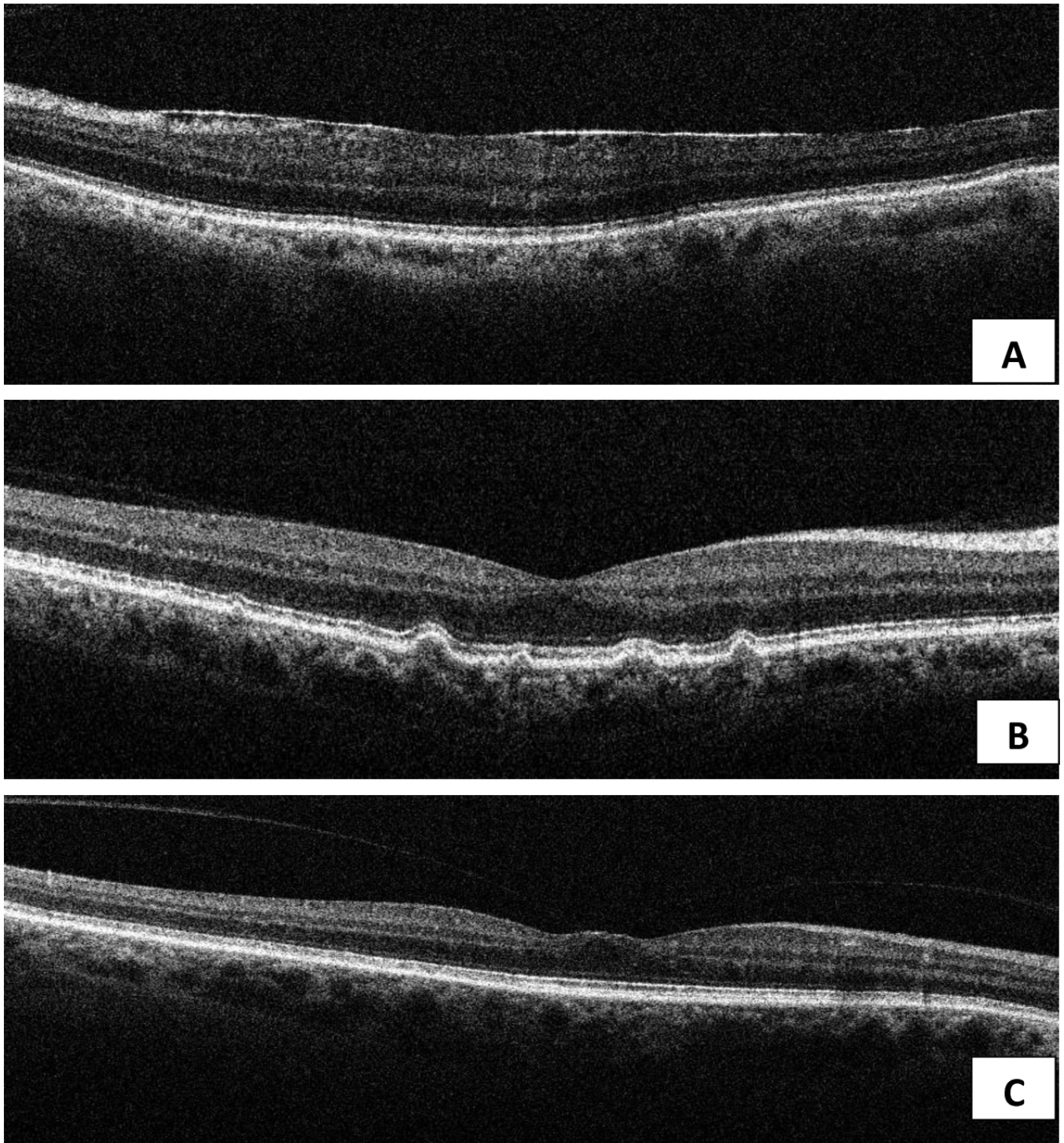


Figure 1. *Some macular pathologies that can be detected by OCT in eyes with cataracts*
(A) *Epiretinal membrane* (B) *Age-related macular degeneration* (C) *Vitreomacular traction*

Table 1. The demographic and clinical characteristics of the patients at the time of presentation

Variables	Values
Age (years, mean±SD)	67.84±8.50
Gender (female/male)	234/274
Side (right/left)	347/358
Intra-ocular pressure (mm Hg, mean±SD)	14.64±2.51
Visual acuity (no of eyes, %)	
<0.1	64 (9.1)
0.1- 0.2	324 (45.9)
≥ 0.3	317 (45.0)
Systemic Diseases (no. of patients, %)	
Diabetes	98 (19.3)
Hypertension	183 (36.0)
Coronary artery disease	51 (10.0)
Chronic obstructive pulmonary disease	22 (4.3)

Table 2. Comparisons of the normal OCT and abnormal OCT groups

Variables	Normal OCT	Abnormal OCT	P value
Age (years, mean±SD)	67.39±8.53	71.44±7.45	<0.001
Gender (female/male)	297/330	36/42	0.861
Preoperative visual acuity (no of eyes, %)			
<0.1	54	10	0.294
0.1- 0.2	285	39	
≥ 0.3	287	30	
Systemic Diseases (no. of patients, %)			
Diabetes	119	18	0.424
Hypertension	224	34	0.207
Coronary artery disease	63	10	0.476
Chronic obstructive pulmonary disease	25	4	0.654

DISCUSSION

Cataract surgery is currently one of the most frequently performed operations and has extremely high success rates. However, accompanying macular pathologies cause visual acuity not to increase to the level expected by the patient and can reduce visual acuity with the progression of the existing pathology over time. Previous studies have shown that in patients with AMD the visual acuity after cataract surgery deteriorated more quickly compared to the healthy eye, and stated that VMT and ERM were risk factors for postoperative macular edema.^{6,7} However, with the recent developments of advanced technology lenses, there has been an increased demand for surgery. The use of these

lenses is relatively contra-indicated in macular diseases. This is because multifocal lenses in patients with macular pathology can reduce contrast sensitivity and this effect can become more evident in dark environments in particular.⁸ Therefore, preoperative determination of macular pathologies is important in respect of predicting visual outcomes, informing the patient of potential postoperative risks, deciding on the use of special lenses such as multifocal lenses, and in determining the frequency of postoperative follow-up. Dilated fundus examination is the basic diagnostic method in the determination of macular pathologies. However, despite the high specificity of fundus examination in the determination of macular pathologies, the sensitivity is

low.⁹ Especially in the early stage, subclinical pathologies such as mild macular edema, VMT, ERM, and AMD do not create visible changes in the macula. Sensitivity is higher in macular OCT, which is a non-invasive, rapid, and easily applicable test in the determination of these pathologies.

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Cataract and macular diseases show an increase together with ageing and risk factors are similar to a significant degree.¹² Therefore, there is a high probability of accompanying macular pathologies in patients who present because of cataract. Various studies have shown macular pathology on OCT in 4.6%-26.7% of cases who are planned to undergo cataract surgery.^{13,10} Abdelmassih et al. determined macular pathology on preoperative OCT in 107 (26.7%) of 401 eyes that were planned to undergo cataract surgery. This rate decreased to 17% when eyes with pathology on fundus examination were excluded. The most common pathology was reported to be AMD (61.7%) followed by ERM and VMT (27.1%).¹⁰ Similarly, in another study which included cases with pathology on fundus examination, pathology was determined on OCT in 21 (21.4%) of 98 eyes and this rate decreased to 10.2% when the eyes with pathology on fundus examination were discounted.¹⁴ In a study by Murphy et al., there was reported to be maculopathy in 166 (26.5%) of 626 patients, but these pathologies could only be determined on OCT in 80 (12.7%) patients. There was reported the most frequent pathologies were seen to be ERM (4.2%), AMD (4%), and VMT (3%).¹⁵ Pinto et al. excluded patients with a history of macular disease, those with a suspicious biomicroscopic fundus examination, and cases for whom a clear image could not be obtained on OCT, and reported that macular pathology was determined with OCT in 47 (4.9%) of 952 eyes. The most common pathologies seen were ERM (3.3%) and AMD (0.7%).¹¹ In a study by Klein et al., 256 eyes of 149 patients with a normal fundus examination for whom the use of advanced technology lenses was planned, were evaluated with OCT and macular pathology was determined in 35 (13.2%) eyes. The most commonly seen pathologies were determined to be AMD (5.7%) and ERM (4.2%).² Another study in China excluded patients with pathology on fundus examination, and reported that pathology was determined on OCT in 294 (25%) of 1176 eyes, and the most common pathologies were ERM (11.5%) and myopic atrophy. It was suggested that ERM was seen more because of the higher rate

of myopia in the Chinese population.¹⁶ Similarly, in two other studies that excluded cases with pathological fundus examination and those for whom a clear image could not be obtained on OCT, macular pathology was determined on OCT at the rates of 10.9% and 4.6%, respectively. ERM and AMD were found to be the most frequently seen pathologies.^{3,13} This variability between the results of studies could be due to whether cases with pathological fundus examination were included or excluded, the number of patients, and different ethnic origins. In the current study, evaluation was made of 705 eyes of 508 patients with a normal preoperative fundus examination who underwent cataract surgery, and macular pathology was determined with OCT in 79 (11.2%) eyes. The most frequently seen pathologies were ERM, AMD, and VMT, respectively.

In some of the above-mentioned studies, the relationship between the demographic characteristics of the patients and macular pathologies was evaluated. (2,10,11,15) Abdelmassih and Pinto reported that macular pathologies were seen statistically significantly more often in patients of advanced age, but no significant correlation was determined between systemic diseases (diabetes, hypertension, cardiovascular disease, dyslipidemia) and macular pathologies.^{10,11} Murphy et al. also stated that the age of cases with maculopathy was significantly older.¹⁵ Klein et al. reported that a statistically significantly higher rate of macular pathologies was seen in males, smokers, and patients with heart disease, but there was no significant association with hypertension, diabetes, and hypercholesterolemia.² In the current study, the mean age of the patients with macular pathology was determined to be significantly higher than that of the patients with no macular pathology. No significant correlation was determined between macular pathologies and gender, preoperative visual acuity, and systemic diseases.

In conclusion, there is a high probability of accompanying macular pathologies in patients of advanced age with cataract. The determination of macular pathologies before cataract surgery is important in terms of predicting visual outcomes, informing the patient of potential postoperative risks, and in deciding the type of lens to be used. Although fundus examination is the basic diagnostic method at this stage, the sensitivity of OCT in the determination of sub-clinical macular pathologies is higher. Therefore, preoper-

ative macular OCT should be added to the routine examination methods for patients who are planned to undergo cataract surgery.

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