

ORIGINAL ARTICLE

Refractive Outcome and Influencing Factors of Postoperative Refraction in Cataract Surgery

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Summary

Introduction. Phacoemulsification with intraocular lens implantation provide high visual acuity after procedure, increasing quality of life and vision. The aim of procedure is to gain a target refraction, in most cases emmetropia, when a patient does not need visual correction for a distant sight (1). Although the preoperative evaluation and surgery technique has developed in the last years, it is not possible to gain the target refraction in all cases. There still are patients with high postoperative error, which means that there are influencing factors that should be identified.

Aim of the Study. Aim of the study was to evaluate the refractive outcome three months after cataract surgery in Pauls Stradins Clinical University Hospital and to find out the factors that influence postoperative refraction after cataract surgery.

Material and methods. Retrospective study included 43 eyes of 38 patients who underwent phacoemulsification's cataract surgery with intraocular lens implantation and fixed A constant. Surgeries were done at PSCUH from August, 2017 till January, 2018. Data were collected at postoperative follow-up three months after surgery (postoperative refraction).

The difference between data intervals was evaluated using nonparametric tests – Mann-Whitney tests. The correlations between postoperative refraction and potentially influencing factors of refractive outcome were evaluated by nonparametric correlation tests – Spearman's rho test.

Results. Of the patients enrolled in the study, whose median age was 75 years (IQR = 78-68 years), 20,9 % (n=9) were men, 51,2% (n=22) had no comorbidities, 34,9% (n=15) had one comorbidity, but two comorbidities had 14% (n=6) patients. At the time of cataract surgery 16,3% (n=7) of patients had Diabetes mellitus, but 46,5 % (n=20) had Glaucoma.

The absolute error between target refraction and postoperative refraction for all cases was 0.48 ± 0.41 D (mean + standard deviation). The main aim of surgery - emmetropic eye - was achieved in 30,2 percent of cases (n=13). In the study, 69.8 percent of cases (n=30) were within ± 0.50 D difference between target and final postoperative refraction, and 90.7 percent of cases (n=39) were within ± 1.00 D.

The study showed moderate and negative correlation between the axial length of eye and refractive outcome of cataract surgery: correlation coefficient $r = -0.412$ ($p = 0.006$). The study showed weak correlation between the age of patients and refractive outcome of cataract surgery $r = 0.091$ ($p = 0.562$). The difference between IOL power calculated using Haigis formula and IOL power of lens implanted during surgery also had a weak correlation with refractive outcome $r = 0.033$ ($p = 0.833$). Correlations between comorbidities and refractive outcome were weak and negative – in case of diabetes mellitus $r = -0.127$ but in case of glaucoma $r = -0.13$.

Conclusions. Cataract surgery outcome showed high quality of this procedure because of the insignificant mean postoperative refractive error. The study did not show statistically significant correlation between refractive outcome and the age of patients, presence of diabetes mellitus or glaucoma and the difference between calculated and implanted IOL power. The study revealed moderate and negative correlation between the axial length and refractive outcome. This correlation coincides with the results of the studies previously made. The refractive outcome is worse for smaller eyes.

Key words: cataract surgery, refractive outcome, influencing factors

INTRODUCTION

Nowadays the phacoemulsification is the leading technique in cataract surgery. Phacoemulsification with intraocular lens implantation provide high visual acuity after procedure, increasing quality of life and vision. The aim of procedure is to gain a target refraction, in most cases emmetropia, when a patient does not need visual correction for a distant sight (1). Although the preoperative evaluation and surgery technique has developed in the last years, it is not possible to gain the target refraction in all cases. According to previous studies for 75-90% of all patients the refractive error after cataract surgery is lower than 1 dioptre (5). Although cataract surgery is very effective and well developed,

there still are patients with high postoperative error, which means that there are influencing factors that should be identified.

AIM OF THE STUDY

The aim of the study was to evaluate the refractive outcome three months after cataract surgery in Pauls Stradins Clinical University Hospital and to find out the factors that influence postoperative refraction after cataract surgery.

MATERIAL AND METHODS

Retrospective study included 43 eyes of 38 patients who underwent phacoemulsification's cataract surgery with

intraocular lens implantation with fixed A constant (A=118,9). Surgeries were done at Pauls Stradins Clinical University Hospital, Ophthalmology clinic from August, 2017 till January, 2018. Data were collected at preoperative evaluation and postoperative follow-up three months after surgery (postoperative refraction). Each patient underwent preoperative evaluation including biometry measurement using Carl Zeiss IOL Master v5 optical biometer to assess axial length of an eye, anterior chamber length, corneal power. For IOL power calculation was used Haigis formula. The aim of postoperative refraction was an emmetropia in the eye which underwent cataract surgery. According to that, the aim of IOL power selection was a power that would ensure a postoperative refraction closest to zero dioptre (plano).

During the preoperative investigation uncorrected visual acuity and best corrected visual acuity of each patient were evaluated. Also, patients were asked whether they have such comorbidities as diabetes mellitus or glaucoma. At the postoperative follow up 3 months after surgery all patients underwent ophthalmological examination to evaluate UCVA and BCVA.

In the study, as possible influencing factors of refractive outcome were evaluated: patient's age, eye's axial length, comorbidities – glaucoma and diabetes mellitus, and the difference between calculated IOL power by Haigis formula and during cataract surgery implanted IOL power.

Cataract surgery was performed using topical anaesthesia by one experienced ophthalmic surgeon. The phacoemulsification's cataract surgery was made using topical anaesthesia, through a temporal clear corneal incision the monoblock foldable hydrophobic acrylic IOL was inserted into the capsular bag (6).

The difference between data intervals was evaluated using nonparametric tests – Mann-Whitney tests. The correlations between postoperative refraction and potentially influencing factors of refractive outcome were evaluated by nonparametric correlation tests – Spearman's rho test. The p value <0.05 was accepted as statistically valid. The correlation coefficient $r < 0.35$ was accepted as weak correlation, $0.35 \leq r \leq 0.65$ was accepted as moderate correlation and $r > 0.65$ was accepted as strong correlation.

RESULTS

Of the patients enrolled in the study, whose median age was 75 years (IQR = 78-68 years) (Table 1), 20,9 % (n=9) were men, but 79,1 % (n=34) were women. 51,2% of the patients (n=22) had no comorbidities, 34,9% (n=15) had one comorbidity, but two comorbidities had 14% (n=6) patients. At the time of cataract surgery 16,3% (n=7) of patients had Diabetes mellitus, but 46,5% (n=20) had Glaucoma (Table 2 and 3).

The absolute error between target refraction and postoperative refraction for all cases was 0.48 ± 0.41 D (mean + standard deviation). The main aim of surgery - emmetropic eye - was achieved in 30,2 percent of cases (n=13). In the study, 69.8 percent of cases (n=30) were

within ± 0.50 D difference between target and final postoperative refraction, and 90.7 percent of cases (n=39) were within ± 1.00 D (Figure 1).

The study showed moderate and negative correlation between the axial length of eye and refractive outcome of cataract surgery: correlation coefficient $r = -0.412$. This correlation is statistically significant because p value = 0.006. The study revealed weak correlation between the age of patients and refractive outcome of cataract surgery $r = 0.091$ (p=0.562). The difference between IOL power calculated using Haigis formula and IOL power of lens implanted during surgery also had a weak correlation with refractive outcome $r = 0.033$ (p=0.833). Correlations between comorbidities and refractive outcome were weak and negative – in case of diabetes mellitus $r = -0.127$ (p=0.416), but in case of glaucoma $r = -0.13$ (p=0.407) (Table 4).

DISCUSSION

Cataract surgery has an essential role in improving quality of vision and life for cataract patients (7). Cataract surgery is very effective treatment method, because it is possible to gain emmetropia for those patients who had only light perception before the surgery (4). Although a preoperative evaluation has been improving year from year, still there are patients with postoperative refraction error higher than 1 dioptre. Therefore, it is important to identify influencing factors.

There are different ways how to evaluate refractive outcome. One of them is to evaluate the difference between postoperative refractive error and target refraction. The absolute error between target refraction and postoperative refraction for all cases was 0.48 ± 0.41 D. Subjective refraction was evaluated after 3 months since the day of surgery, when the postoperative refraction was already stable (3). Comparing the results with other studies, it is possible to observe the high quality of cataract surgery made in Pauls Stradins Clinical University Hospital, Ophthalmology clinic. In the study made in Sweden in 2006 the absolute error between target refraction and postoperative refraction was 0.56 ± 0.66 D, which is about 0,11 dioptre worse outcome than in this study (5).

The absolute error between target refraction and postoperative refraction was lower than 1 dioptre in 90,7% of all cases. This ratio is higher than in the study made in Sweden in 2006 (83,8%)(5). According to national benchmarks of the USA, ophthalmic surgeons should aim for the achieved refraction to be within 0.5 D of the target about 55% of the time and within 1.0 D in about 85% of cases.

The study showed moderate and negative correlation between the axial length of eye and refractive outcome of cataract surgery. The smaller axial length of eye, the higher refractive error after cataract surgery. Also, previously made study in 2009 showed that the worst refractive outcome was in those eyes, which axial length < 22mm (2). Refractive outcome for eyes with AL between 22mm and 25mm was better than eyes with AL < 22mm and equal with eyes with AL > 25mm (2).

Therefore, axial length of eye could be an influencing factor of refractive outcome after cataract surgery. The study revealed weak correlation between the age of patients and refractive outcome, the difference between IOL power calculated using Haigis formula and IOL power of lens implanted during surgery also had a weak correlation with refractive outcome. The study made in Sweden in 2006 also showed that the age of patients should not be considered as possible influencing factor of refractive outcome (2; 4). Correlations between comorbidities and refractive outcome were weak and negative. However, previously made study revealed that glaucoma should be considered as possible influencing factor (4).

CONCLUSIONS

Cataract surgery outcome showed high quality of this procedure because of the insignificant mean postoperative refractive error. The study did not show statistically significant correlation between refractive outcome and the age of patients, presence of diabetes mellitus or glaucoma and the difference between calculated and implanted IOL power. The study revealed moderate and negative correlation between the axial length and refractive outcome. This correlation coincides with the results of previous made studies. The refractive outcome is worse for smaller eyes.

Table 1. The median age of patients enrolled in the study

Percentile		5	10	25	50	75	90	95
Weighted Average	Age	54,4	58,8	68,0	75,0	78,0	82,2	85,6

Table 2. Characteristics of patients sex and number of comorbidities

			Comorbidities			Total
			0	1	2	
Sex	man	No.	7	2	0	9
		% of men	77,8	22,2	0,0	100,0
	woman	No.	15	13	6	34
		% of women	44,1	38,2	17,6	100,0
In total		No	22	15	6	43
		% of all patients	51,2	34,9	14,0	100,0

Table 3. Characteristics of patients comorbidities

	Diabetes mellitus		Glaucoma	
	No.	%	No.	%
Have not	36	83,7	23	53,5
Have	7	16,3	20	46,5
Total	43	100,0	43	100,0

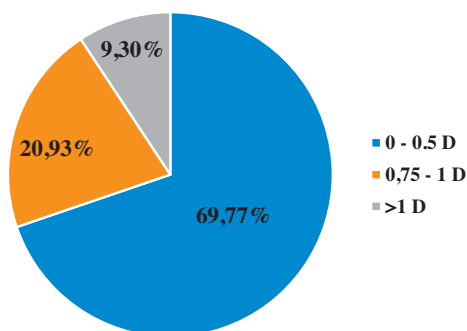


Fig. 1. Refractive outcome after cataract surgery

Table 4. Correlation between refractive error and influencing factors

		RE	Age	AL	Dif.	Com.	DM	Glau.
RE	Correlation	1,000	,091	-,412	,033	-,133	-,127	-,130
	Sig. (2-tailed)	.	,562	,006	,833	,396	,416	,407
	No	43	43	43	43	43	43	43
Age	Correlation	,091	1,000	-,066	-,377*	-,029	-,122	,047
	Sig. (2-tailed)	,562	.	,674	,013	,854	,436	,765
	No	43	43	43	43	43	43	43
AL	Correlation	-,412	-,066	1,000	,010	-,016	,079	-,030
	Sig. (2-tailed)	,006	,674	.	,951	,918	,616	,848
	No	43	43	43	43	43	43	43
Dif.	Correlation	,033	-,377*	,010	1,000	-,044	,018	-,028
	Sig. (2-tailed)	,833	,013	,951	.	,778	,910	,858
	No	43	43	43	43	43	43	43
Com.	Correlation	-,133	-,029	-,016	-,044	1,000	,667	,924**
	Sig. (2-tailed)	,396	,854	,918	,778	.	,000	,000
	No	43	43	43	43	43	43	43
DM	Correlation	-,127	-,122	,079	,018	,667**	1,000	,347*
	Sig. (2-tailed)	,416	,436	,616	,910	,000	.	,023
	No	43	43	43	43	43	43	43
Glau.	Correlation	-,130	,047	-,030	-,028	,924**	,347*	1,000
	Sig. (2-tailed)	,407	,765	,848	,858	,000	,023	.
	No	43	43	43	43	43	43	43

Conflict of interest: None

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