• Clinical Research •

Late in-the-bag spontaneous IOL dislocation: risk factors and surgical outcomes

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Abstract

• AIM: To evaluate the possible predisposing risk factors for late in-the-bag spontaneous IOL dislocations and to study the early surgical and visual outcomes of repositioning and exchange surgeries.

• METHODS: Medical and surgical records of 39 eyes of 39 patients who underwent IOL repositioning or exchange surgery for dislocation between 2010 and 2018 were reviewed. Possible predisposing risk factors and some characteristics of late in-the-bag spontaneous IOL dislocations; outcomes of IOL repositioning and exchange surgeries, including visual acuity, refractive status before and after surgery and postoperative complications were evaluated.

• RESULTS: The predisposing factors for late in-the-bag spontaneous IOL dislocations were pseudoexfoliation [PEX; 12/39 (30.8%)], previous vitreoretinal surgery [7/39 (17.9%)], axial myopia [3/39 (7.7%)], both PEX and axial myopia [1/39 (2.6%)], both previous vitreoretinal surgery and axial myopia [2/39 (5.1%)] and uveitis [1/39 (2.6%)]. The mean interval between cataract and dislocation surgery was 7.23y, greater in PEX positive group (8.63y). The mean best corrected visual acuity (BCVA) improved significantly after dislocation surgery (*P*<0.001) and also improved significantly after exchange surgery (*P*=0.001). The mean value of spherical equivalant decreased significantly after dislocation surgery (*P*=0.011), whereas corneal astigmatism increased but this difference was not significant after dislocation surgery and exchange surgery (*P*=0.191, *P*=0.074, respectively).

• CONCLUSION: The most prevelant risk factors for late in-the-bag spontaneous IOL dislocations are PEX, previous vitreoretinal surgery and axial myopia. In the management of IOL dislocations, exchange surgery with small corneal incision seemed effective with improved BCVA and safety with low postoperative complications.

• **KEYWORDS:** IOL dislocation; risk factors; IOL repositioning; IOL exchange

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INTRODUCTION

One of the most serious complications of uneventful cataract surgeries is late in-the-bag intraocular lens (IOL) dislocations. Dislocation of the IOL-capsule complex was first described in 1993[1] and has been reported with an increasing frequency in recent years[2]. Late spontaneous IOL dislocation within the capsular bag (more than 3mo after surgery) occurs several years after cataract surgery and depends upon slowly progressive dehiscence of the zonules[3-4]. Possible predisposing factors suggested for late in-the-bag dislocations are pseudoexfoliation (PEX), previous vitreoretinal surgery, axial myopia, uveitis, retinitis pigmentosa and connective tissue disorders[5-9].

If the dislocation causes visual symptoms or some complications, repositioning or exchange of the IOL is required. The optimal management for late in-the-bag IOL dislocation is still being questioned. Different surgical procedures such as repositioning of the existing IOL by fixating it to scleral wall or to the iris or exchanging the capsule-IOL complex with a new IOL are performed[2]. The purpose of the study were to clarify the possible predisposing factors for late spontaneous in-the-bag IOL dislocations and to evaluate the early outcomes of surgical methods.

SUBJECTS AND METHODS

Ethical Approval The study was approved by the Ethics Committee of the Kocaeli University and conformed to the guidelines of the Declaration of Helsinki. An informed consent was obtained from all individual participants included in the study.

Subjects This retrospective study was conducted with medical and surgical records of all the subjects who required surgical

management because of spontaneous dislocation of posterior chamber IOLs within the capsular bag after cataract surgery. During January 2010 and July 2018, a total of 39 eyes of 39 patients were included in the study if spontaneous IOL dislocation was diagnosed 3mo or later after uneventful cataract surgery with endocapsular IOL implantation.

Indications for dislocation surgery were visual symptoms or rapid and distinct dislocation. Follow up after dislocation surgery of at least 1mo was required. Subjects of IOL dislocation from ocular trauma were excluded. Main exclusion criteria were out-of-the bag IOL dislocations and dislocations that occured after complicated cataract surgery in the first 3mo. The data included age, sex, side, at the time of cataract surgery, predisposing factors for dislocation, interval between cataract surgery and dislocation, the type of the surgical procedure to manage IOL dislocation, axial length, grade, type and place of IOL dislocation, follow-up time, preoperative and postoperative logarithm of the minimal angle of resolution (logMAR) uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA), intraocular pressure (IOP), spherical equivalant, corneal astigmatism, refractive astigmatism and postoperative complications were rewieved. The refractive states (spherical equivalant, corneal and refractive astigmatism) were examined objectively using an autorefractometer and keratometer (NIDEK ARK-530A, Japan). LogMAR visual acuity was measured before and 1mo after dislocation surgery.

Dislocation grade was identified as small, moderate or total. If the IOL is centered but a gap is present between the pupillary margin and the IOL and related with diplopia and pseudophakodonesis that was defined as small. In moderate dislocation, IOL is decentered and observed in the pupillary area which related with reduction in patient's vision. In total dislocation, the IOL is not visible in pupillary area[10]. The place of IOL dislocation (inferior, superior or vitreous cavity) was evaluated after mydriasis.

Surgical Procedures The dislocation surgeries were performed by two experienced surgeons (an anterior segment surgeon and a posterior segment surgeon) in one center. The same protocol was followed during the surgeries, all posterior approaches were performed by the same posterior segment surgeon. The choice of surgery type was the surgeon's preference. Especially exchange surgery was applied to patients who had opacification on optics, inflammatory accumulation, and usually monoblock lenses that were damaged in their haptics. All surgeries were performed using peribulbar anesthesia. We choosed the anterior approach with scleral sutures, iris sutures or exchange tecnique if the IOL is dislocated along the iris plane only and some piece of the optic is visible in the pupil. If the IOL dislocated posteriorly in the vitreous cavity or laterally from the posterior chamber to the vitreous, we choosed posterior approach with pars plana vitrectomy. In anterior approach, when there is vitreus strands prolapsed around or in front of the IOL, we performed anterior vitrectomy. Then, the original IOL's dislocated haptic was repositioned to peripheral iris with iris sutures in posterior chamber. IOL reposition with scleral sutures was performed using an ab externo scleral fixation technique with temporary haptic externalization for the placement of scleral fixation suture[11].

In the exchange surgery, the dislocated IOL was pulled up into the anterior chamber (AC) through side ports using a forceps. When the IOL was dislocated into the vitreous cavity, pars plana vitrectomy (PPV) was performed and IOL lifted up into the AC using an internal limitan membrane forceps. IOL was cut in the AC with IOL cutting microscissors and removed from approximately a 3 or 3.5 mm cornea scleral incision. After anterior vitrectomy, three piece foldable IOL (Sensar AR40 Allergan, UK) was sutured with transcleral fixation by limbal approach[12]. Postoperative treatment included topical antibiotic for 1wk and steroidal drops for 4wk.

Statistical Analysis All statistical analyses were performed using IBM SPSS for Windows version 20.0 (IBM Corp., Armonk, NY, USA). Kolmogorov-Smirnov tests were used to test the normality of data distribution. Continuous variables were expressed as mean±standard deviation (SD), median (25^{th}-75^{th} percentiles), and categorical variables were expressed as counts (percentages). Comparisons of normally distributed continuous variables between the groups were performed using the Student's *t*-test. Comparisons of nonnormally distributed continuous variables between the groups were performed using the Mann Whitney *U* test. Comparisons of normally distributed continuous paired variables between the times were performed using the paired samples *t*-test and nonnormally distributed continuous variables between the times were performed using the Wilcoxon *t*-test. Comparisons of cathegorical variables between the groups were performed using the Fisher's exact Chi-square test, Yates' Chi-square test and Monte Carlo Chi-square test. A two-sided P value <0.05 was considered statistically significant.

RESULTS

Thirty-nine eyes of 39 patients fulfilled the criteria of spontaneous late dislocated in-the-bag IOL were included in the study. There were 26 (66.7%) males and 13 (33.3%) females. The mean age at cataract surgery was 62.77±14.62y (range, 23 to 87y) and the mean age at the time of dislocation was 70.05±13.09y (range, 39 to 89y). The interval between the uneventful cataract surgery and the spontaneous dislocation was 7.23±4.69y (range, 1 to 23y). The distrubition of the interval between the cataract and the dislocation surgery is shown in Figure 1 and Table 1.

Table 1 Characteristics of all patients and main predisposing factors mean±SD

Characteristics	Total (*n*=39)	Pseudoexfoliation (*n*=13)	Previous vitreoretinal surgery (*n*=9)	Axial myopia (*n*=6)	*P*
Age at cataract surgery, y	62.77±14.62	70.38±5.22	54.67±17.07	52.83±21.27	0.003[a], 0.057[b], 0.070[c]
Age at IOL dislocation, y	70.05±13.09	79±4.65	60.22±14.99	63±15.84	<0.001[a], 0.008[b], 0.154[c]
Interval, y	7.23±4.69	8.62±2.72	5.56±4.79	9.83±6.91	0.197[a], 0.227[b], 0.142[c]
Sex, *n* (%)					
Male	26 (66.7)	10 (76.9)	5 (55.6)	3 (50)	0.548[a], 0.447[b], 0.346[c]
Female	13 (33.3)	3 (23.2)	4 (44.4)	3 (50)	
Side, *n* (%)					
Right	21 (53.8)	7 (53.8)	4 (44.4)	4 (66.7)	1.000[a], 0.706[b], 0.493[c]
Left	18 (46.2)	6 (46.2)	5 (55.6)	2 (33.3)	
Axial length, mm	24.36±1.41	23.59±1.11	25.24±1.52	26.87±0.83	0.014[a], 0.032[b], <0.001[c]

[a]Comparison between with pseudoexfoliation and without pseudoexfoliation; [b]Comparison between with previous vitreoretinal surgery and without previous vitreoretinal surgery; [c]Comparison between with axial myopia and without axial myopia.

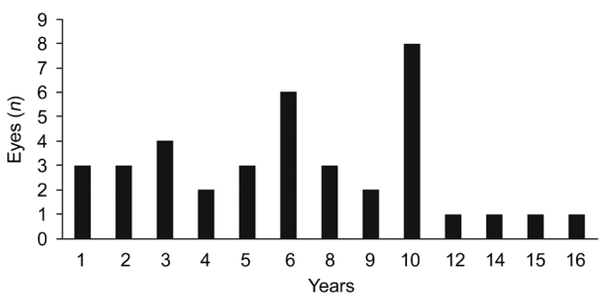

Figure 1 Years between cataract surgery and IOL dislocation.

Possible main predisposing factors of the 39 eyes that experienced in-the-bag dislocation were PEX, in 12 eyes (30.8%); previous vitreoretinal surgery in 7 (17.9%); axial myopia in 3 (7.7%); both PEX and axial myopia together, in 1 (2.6%); both previous vitreoretinal surgery and axial myopia together in 2 (5.1%) and uveitis in 1 (2.6%). There were no identifiable predisposing factors in 13 eyes (33.3%). The reasons of previous vitreoretinal surgery include rhegmatogenous retinal deteachment (*n*=6), epiretinal membrane (*n*=1), maculer hole (*n*=1) and hemorrhagic retinal deteachment related with age related macular degeneration (*n*=1). Characteristic data of all patients and main predisposing factors were listed in Table 1.

The mean preoperative IOP of the eyes with IOL dislocation was 17.85±7.98 mm Hg (range, 10.0 to 42.0 mm Hg). The mean postoperative IOP of the eyes was 14.13±2.38 mm Hg (range, 10.0 to 18.0 mm Hg). There was statistically significant reduction between preoperative and postoperative IOP values (*P*=0.002). For regulation of IOP of 8 eyes, we used medical treatment postoperatively and for 1 eye, we used surgical treatment (trabeculectomy). The distribution of the patients in the main predisposing factor groups that require postoperative IOP regulation is shown in Table 2. Thirty eight (97.4%) IOL dislocations were downward from the IOL plane, and 1 (2.6%) to the vitreous cavity. Twenty eight (71.8%) IOL dislocations were moderate grade (Table 2).

The dislocated IOL was replaced by an anterior approach with or without anterior vitrectomy in 35 cases (89.7%) and a posterior approach with pars plana vitrectomy in 4 cases (10.3%). The IOL was repositioned in the posterior chamber with scleral sutures in 15 (35.8%), with iris sutures in 2 (5.1%) and exchanged in 18 (46.2%) cases with anterior approach. The IOL was repositioned in the posterior chamber with scleral sutures in 3 (7.7%) and exchanged in 1 (2.6%) cases with posterior approach with pars plana vitrectomy (Table 3).

The visual outcomes of all patients and surgical types are presented in Table 4. Overal, the mean logMAR BCVA had improved significantly from preoperative 0.63 to postoperative 0.42 (*P*<0.001). The mean value of spherical equivalant decreased (*P*=0.011), corneal astigmatism increased, but the increase was not significant (*P*=0.191) and refractive astigmatism did not change after surgery (*P*=1.000). In addition, the mean logMAR BCVA had improved significantly from preoperative 0.64 to postoperative 0.21 (*P*=0.001) in exchange surgery group. The spherical equivalant was decreased and corneal astigmatism was increased after IOL exchange surgery but they were not significantly different (*P*=0.109, 0.074, respectively). Seventy four percent of the total eyes (29/39) attained gain of more than 1 line after dislocation surgery with 70% (14/20) in the repositioning surgery group and 78.9% (15/19) in exchange surgery group.

The overal complication rate after the dislocation surgery was 35.9%. The postoperative complications were glaucoma (5 eyes, 12.8%; one of them had PEX glaucoma previously; two of them were miyopic dislocation), vitreous hemorrhage (1 eye, 2.6%; this patient was operated previously because of retinal deteachment), corneal decompansation (2 eyes, 5.1%; one of them was treated intravitreal dexamethasone implantation previously because of retinal pathology which moved to anterior segment and caused corneal decompansation; other one was a nonregulated diabetic patient who was vitrectomized

Table 2 Pre- and postoperative evaluations of all patients and main predisposing factors

Parameters	Total (*n*=39)	Pseudoexfoliation (*n*=13)	Previous vitreoretinal surgery (*n*=9)	Axial myopia (*n*=6)
IOP, mean±SD, mm Hg				
Preoperative	17.85±7.98	17.92±7.63	17.92±7.63	20.17±8.90
Postoperative	14.13±2.38	14.38±2.29	14.38±2.29	14.67±2.33
Postoperative IOP management, *n* (%)				
Medical treatment	8 (88.9)	3 (75)	1 (100)	2 (100)
Trabeculectomy	1 (11.1)	1 (25)	0	0
Grade of IOL dislocation, *n* (%)				
Small	5 (12.8)	1 (7.7)	0	0
Moderate	28 (71.8)	11 (84.6)	8 (88.9)	5 (83.3)
Total	6 (15.4)	1 (7.7)	1(11.1)	1 (16.7)
Place of IOL dislocation, *n* (%)				
At IOL plane, inferior	38 (97.4)	13 (100)	9 (100)	6 (100)
At IOL plane, superior	0	0	0	0
Vitreous cavity	1 (2.6)	0	0	0
Ocular comorbidity, *n* (%)				
Glaucoma	6 (15.4)	5 (38.5)	0	0
AMD	4 (10.3)	1 (7.7)	1 (11.1)	0
Epiretinal membrane	3 (7.7)	1 (7.7)	1 (11.1)	1 (16.7)
Macular hole	1 (2.6)	0	1 (11.1)	0
Retinal deteachment surgery	6 (15.3)	0	6 (66.6)	1 (16.7)
None	19 (48.7)	6 (46.2)	0	4 (66.7)
Predisposing factors, *n* (%)				
PEX	12 (30.8)	12 (92.3)	-	-
Previous vitreoretinal surgery	7 (17.9)	-	7 (77.8)	-
Axial myopia (≥26 mm)	3 (7.7)	-	-	3 (50)
PEX+axial myopia	1 (2.6)	1 (7.7)	-	1 (16.7)
Previous vitreoretinal surgery+axial myopia	2 (5.1)	-	2 (22.2)	2 (33.3)
Uveitis	1 (2.6)	-	-	-
None	13 (33.3)	-	-	-

IOP: Intraocular pressure; AMD: Age-related macular degeneration; PEX: Pseudoexfoliation.

Table 3 Surgical types of cases with in-the-bag dislocated IOL *n* (%)

Type of surgery	Cases
Anterior approach with or without anterior vitrectomy	
IOL repositioning with scleral sutures	15 (35.8)
IOL repositioning with iris sutures	2 (5.1)
IOL exchanged	18 (46.2)
Posterior approach with pars plana vitrectomy	
IOL repositioning with scleral sutures	3 (7.7)
IOL repositioning with iris sutures	0
IOL exchanged	1 (2.6)

because of macular hole previously), tilted IOL (1 eye, 2.6%; previously PEX glaucoma), endophthalmitis (1 eye, 2.6%; PEX), both glaucoma and cystoid macular edema (2 eyes, 5.1%; one of them had PEX glaucoma previously, other one was miyopic dislocation), both glaucoma and retinal deteachment (2 eyes, 5.1%; Table 5).

DISCUSSION

Dislocation of IOLs are optical malpositioning complications of cataract surgery. IOLs seem to be dislocated with respect to time in a bimodal distribution[13]. Early dislocations ocur due to improper IOL fixation within the secure capsular bag and usually caused by tearing of the posterior capsule and zonular rupture. Late dislocations occur three months or later after uncomplicated cataract surgery as a result of progressive zonular weakness. Zonular insufficiency is the common cause of in-the-bag late IOL dislocations[4,8,10]. The rate of posterior chamber IOL dislocations has been reported as 0.2% to 3% and late spontaneous dislocation is a small part of this group[10,14]. There are many predisposing factors associated with zonular weakness including PEX, previous vitreoretinal surgery, axial myopia, uveitis, retinitis pigmentosa and connective tissue disorders. Most of the previous studies of spontaneous in-the-bag late IOL dislocation concluded that PEX was the most common significant risk factor[15-18]. In our study, similar to the previous studies the most predisposing risk factor was PEX in 12 eyes (30.8%). PEX accumulations mechanically weaken the zonule, and impair zonular anchoring. When enough

Table 4 Pre- and postoperative visual outcomes of all patients and surgery types *n* (%)

Parameters	Total (*n*=39)		Repositioning surgery (*n*=20)		Exchange surgery (*n*=19)		*P*
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	
UCVA, mean±SD	0.89±0.59	0.68±0.53	0.91±0.56	0.86±0.61	0.87±0.62	0.50±0.36	
0.1 or beter	0	2 (5.1)	0	0	0	2 (10.5)	
0.2-0.4	11 (28.2)	15 (38.5)	5 (25)	6 (30)	6 (31.6)	9 (47.4)	0.007[a], 0.055[b], 0.002[c]
0.5-0.9	7 (17.9)	10 (25.6)	2 (10)	5 (25)	5 (26.3)	5 (26.3)	
1 or worse	21 (53.8)	12 (30.8)	13 (65)	9 (45)	8 (42.1)	3 (15.8)	
BCVA, mean±SD	0.63±0.57	0.42±0.55	0.62±0.50	0.62±0.68	0.64±0.64	0.21±0.24	
0.1 or beter	7 (17.9)	16 (41)	1 (5)	5 (25)	6 (31.6)	11 (57.9)	
0.2-0.4	13 (33.3)	13 (33.3)	9 (45)	7 (35)	4 (21.1)	6 (31.6)	<0.001[a], 0.067[b], 0.001[c]
0.5-0.9	5 (12.8)	6 (15.4)	2 (10)	4 (20)	3 (15.8)	2 (10.5)	
1 or worse	14 (35.9)	4 (10.3)	8 (40)	4 (20)	6 (31.6)	0	
Spherical equivalant, median (25^{th}-75^{th} percentiles)	7.0 (1.37-11)	1.50 (1.50-2.50)	2.00 (1.0-11.0)	1.50 (1.50-2.75)	8.0 (3.0-11.0)	1.50 (1.50-2.0)	0.011[a], 0.051[b], 0.109[c]
Corneal astigmatism, median (25^{th}-75^{th} percentiles)	1.90 (1.19-2.89)	2.50 (1.50-3.50)	2.75 (1.31-3.73)	2.50 (2.00-3.00)	1.45 (0.97-2.22)	2.25 (0.81-3.50)	0.191[a], 0.838[b], 0.074[c]
Refractive astigmatism, median (25^{th}-75^{th} percentiles)	2.00 (2.00-2.00)	2.00 (1.00-2.00)	2.00 (2.00-2.00)	2.00 (2.00-3.00)	2.50 (0.50-3.75)	1.50 (1.00-2.00)	1.000[a], 0.317[b], 0.414[c]
Lines change of BCVA							
Loss 1-2 lines	3 (7.7)		3 (15)		0		0.301[a]
Same	7 (17.9)		3 (15)		4 (21.1)		
Gain more than 1 line	29 (74.4)		14 (70)		15 (78.9)		
Cause of BCVA 0.4 or worse	16 (41.02)		11 (55)		5 (26.31)		
Glaucoma	7		4		3		
AMD	2		2		0		
Epiretinal membrane	2		0		2		
Endophthalmitis	1		1		0		-
Previous retinal deteachment surgery	1		1		0		
Corneal decompansation	2		2		0		
Vitreous hemorrhage	1		1		0		

UCVA: Uncorrected visual acuity; BCVA: Best corrected visual acuity; IOP: Intraocular pressure; AMD: Age-related macular degeneration. [a]Comparison between pre- and postoperative values in total group; [b]Comparison between pre- and postoperative values in repositioning surgery group; [c]Comparison between pre- and postoperative values in exchange surgery group.

Table 5 Postoperative complication rates after dislocated IOL surgeries *n* (%)

Complications	All procedures (*n*=39)	Exchange surgery (*n*=19)	Repositioning surgery (*n*=20)
Glaucoma	5 (12.8)	3 (18.8)	2 (10)
CME	0	0	0
RD	0	0	0
Vitreous hemorrhage	1 (2.6)	0	1 (5)
Corneal decompansation	2 (5.1)	0	2 (10)
Tilted IOL	1 (2.6)	0	1 (5)
Suture exposure requiring scleral flap surgery	1 (2.6)	1 (5.3)	0
Endophthalmitis	1 (2.6)	0	1 (5)
Glaucoma+CME	2 (5.1)	1 (5.3)	1 (5)
Glaucoma+RD	1 (2.6)	1 (5.3)	0
None	25 (64.1)	13 (68)	11 (55)

CME: Cystoid macular edema; RD: Retinal deteachment.

zonules are breached, dislocation of the bag-IOL complex occurs[19-20]. In our study, the overall mean time from cataract surgery to in-the bag IOL dislocation was 7.23y. In the PEX group, the intervale was 8.63y. This results are similar to those reported in previous studies of late in-the-bag IOL dislocations in which major predisposing factor was identified as PEX (*e.g.* 6.9y[21], 8.3y[3], 8.5y[10] and 10.3y[22]). The analysis of the eyes with and without PEX revealed some significant differences: the mean age at cataract surgery (70.38y, *P*=0.003) and dislocation surgery (79y, *P*<0.001) were older in patients with

PEX and they had a shorter axial lenght (23.59 mm, *P*=0.014). These findings were similar to the previous studies reported by Krėpštė *et al*[10] and Davis *et al*[13]. And also, age at IOL dislocation was significantly younger (60.22y, *P*=0.008) than others in our previous vitreoretinal surgery group similar to Davis *et al*[13]. Most of the patients who underwent dislocation surgery were males (66.7%) in total group and (76.9%) in PEX group like previously reported in other studies, they suggest that there may be a gender related difference that results in weaker zonula in men with PEX[3,21,23].

Previous studies have analyzed whether the type of posterior chamber IOL can influence the risk of in the bag lens dislocation. The most common dislocated IOL was 3 piece acrylic in the studies of Hayashi *et al*[3] and Lorente *et al*[24] and 1 piece PMMA in the studies of Gimbel *et al*[2], Kim *et al*[15] and Gross *et al*[21]. However, none of these studies allow us to evaluate the risk for spontaneous late dislocation associated with a particular IOL material or design because they did not include a control group. Davis *et al*[13] indicated that all types of IOL could be involved. The preponderance of 1 type of IOL over others more likely reflects the most commonly used IOL at the time of original surgery. In our study, all dislocated IOLs were hydrophobic material because of this we did not make any comparison of the effect of this condition on dislocation.

Several associated conditions were detected (glaucoma, age-related macular degeneration, epiretinal membrane, macular hole, previous retinal deteachment surgery) in our patients. The most common condition was glaucoma which was detected in 6 eyes before surgery, 5 of which presented with pseudoexfoliation. We observed a normalization of IOP after surgical correction of IOL position in 1 case spontaneously, in 3 cases with medical therapy and in 1 case with trabeculectomy in patients with pseudoexfoliation. In other predisposing factor groups we required medical treatment for IOP decrease after dislocation surgery which was not enough alone. Several previous studies have reported an association between late in-the-bag IOL dislocation and increased IOP[24-25]. Regardless of the explanatory mechanism, there are examples where associated high IOP has been resolved by IOL dislocation surgery, either completely or partially[16,24]. But both studies have few patients and this condition limits their ability to examine the possible IOP-lowering effect of dislocation surgery. Kristianslund *et al*[22] reported that increased IOP after in-the-bag IOL dislocation can not be resolved by dislocation surgery alone and IOL exchange surgery may have a more benefical effect on the postoperative IOP compared to repositioning surgery.

Different surgical techniques can be used in management of dislocated IOL. The choice of surgical thecnique depends on the surgeon's preferences and management of the IOL with different suturing techniques and if the IOL is preserved or exchanged[2]. There is no consensus on which technique to use and several surgical methods are suggested to give good results[2,21]. In some eye clinics, dislocated IOLs are operated by only vitreoretinal surgeons, in others, such as in ours, also anterior segment surgeons manage these conditions that IOL-capsule complex can be identified in the pupillary area. We used to compare 2 principally different operation methods. One of them posterior chamber IOL fixation with transcleral or iris suturing of patients original IOLs. Other method is exchange the original IOL to new three piece foldabl IOL which was implanted to posterior chamber with transcleral fixation sutures. In the exchange surgery group, we experienced a significant improvement in BCVA postoperatively and 78.9% of the patients reached gain of more than 1 line at 1mo postoperative follow-up. In the repositioning surgery group, we did not experienced a significant improvement in BCVA postoperatively and 15% of patients reached loss of 1-2 lines at 1mo postoperative follow-up. We think that this result is due to serious postoperative complications (retinal deteachment, endophthalmitis, corneal decompansation) in repositioning group. Because, furthermore, 70% of the patients reached gain of more than 1 line in repositioning group and this result was close to the exchange surgery group. Therefore, mean logMAR BCVA improved significantly from 0.63 to 0.42 (*P*<0.001), and logMAR BCVA of 0.4 or better achieved in 74.3% of all patients. In exchange surgery group, mean logMAR BCVA improved significantly from 0.64 to 0.21 (*P*=0.001), with logMAR BCVA of 0.4 or better achieved in 89.5%. The mean logMAR BCVA of 0.3 or better achived in 47.5% and 62.22% after exchange surgery in Fernández-Buenaga *et al*[18] and Lorenta *et al*[24] studies respectively. Fernández-Buenaga *et al*[18] have attributed this result to postoperative serious complications. High complication rate was seen in our study because of the ocular comorbidities of patients which was explained in results. The most of specified complications were related with the ocular history of the patients, not related with dislocation surgery.

In some of previous studies compairing IOL repositioning with IOL exchange by different thecniques, suggested that the operation methods had similar efficacy in terms of visual outcome[22,24-26]. On the other hand, some authors agree that it is desirable to reposition the existing IOL if possible, to avoid the complications related with exchange surgery such as induced corneal astigmatism and surgical trauma because of large corneal wound[3]. In our study, all removed lenses were foldabl and cut through a small incision and implantation of new three piece foldable IOL was performed through this small incision. We observed that corneal astigmatism increased after both of the surgical type but the difference did not reach statistical significance in two methods.

In conclusion, our study includes the comparison of risk factors for late dislocations as well as comparison of two different specific surgical methods for the treatment of this condition. It highlights that PEX is an important predisposing factor for the spontaneous late in-the-bag IOL dislocation after uneventful cataract surgery. Dislocation related with PEX occured at an older age than other predisposing factors. It shows that small incision exchange surgeries can be performed safely in dislocations and the effects on refractive state will not be worse than repositioning surgery by means of visual acuity improvement. IOL exchange with transcleral suturing with small corneal incision was a good and safe technique, postoperative visual outcomes improved significantly with low complication rates.

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