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Phacoemulsification in eyes with cataract and pseudoexfoliation syndrome

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超声乳化术治疗假性剥脱综合征白内障患者的疗效分析

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摘要

目的:评估在白内障超声乳化手术时使用适当的手术技巧及相应设备对假性剥脱综合征白内障患者的视力及术中、术后并发症的影响。

方法:回顾性研究。选取53例67眼假性剥脱综合征白内障患者接受超声乳化及人工晶状体植入术。平均年龄71.68±9.96(53~89)岁,其中男性24例(45%),女性29例(55%),包括核性、皮质性及后囊下和成熟期的白内障。

结果:核性白内障较其他类型更为常见(P=0.00)。术前平均最佳矫正视力为0.99±0.30(0.40~1.50) LogMAR,术后平均最佳矫正视力为0.32±0.31(0.00~1.00) LogMAR(P=0.00)。运用虹膜牵拉器12眼(18%)。囊袋张力环植入15眼(22%),其中按计划植入8眼(12%),未计划7眼(10%)。后囊破裂4眼(6%),其中玻璃体脱出2眼(3%),并接受前段玻璃体切割术;且由于后囊破裂较大,此2眼(3%)转为白内障囊外摘除术。持续性角膜水肿4眼(6%),前房反应5眼(7%)。人工晶体脱位4眼(6%),仅1眼(1.5%)需复位。后囊混浊并接受Nd:YAG激光后囊切开术13眼(20%)。

结论:假性剥脱综合征白内障患者术后视力良好,但术中及术后可能出现的并发症包括后囊破裂,玻璃体脱出,转为白内障囊外摘除术,持续性角膜水肿,前房反应及人工晶状体脱位。为避免并发症的发生,适当的手术技巧和相应设备的使用在手术时是必不可少的。

关键词:白内障超声乳化术;白内障;假性剥脱综合征;囊袋张力环;虹膜牵拉器

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Abstract

• AIM: To evaluate the visual outcomes and intraoperative and postoperative complications of phacoemulsification surgery in patients with cataract and pseudoexfoliation syndrome (PEX) and the usage of proper surgical techniques and appropriate devices intraoperatively.

• METHODS: Sixty-seven eyes of 53 patients with PEX and cataract who had undergone phacoemulsification and intraocular lens (IOL) implantation surgery were evaluated retrospectively. The mean age was 71.68±9.96 (53-89)y, and there were 24 (45%) males and 29 (55%) females. Nuclear, cortical, posterior subcapsular, and mature cataracts were all represented.

• RESULTS: Nuclear cataract was significantly more common than other types (P = 0.00). The mean preoperative best corrected visual acuity (BCVA) was 0.99±0.30 (SD) (0.40-1.50) logMAR, and the mean postoperative BCVA was 0.32±0.31 (SD) (0.00-1.00) logMAR (P=0.00). Iris retractors were used in 12 (18%) eyes. Capsular tension ring (CTR) implantation was used in 15 (22%) eyes, it was planned in 8 (12%) and unplanned in 7 (10%). Posterior capsule rupture occurred in 4 (6%) eyes, and vitreous loss occurred in 2 (3%) eyes. Anterior vitrectomy was performed in these 2 eyes. Conversion to extracapsular cataract extraction (ECCE) was needed in these 2 (3%) eyes due to large posterior capsular rupture. Persistent corneal edema was observed in 4 (6%) eyes, and anterior chamber reaction in 5 (7%) eyes. IOL dislocation occurred in 4 (6%) eyes, but repositioning was only needed in 1 (1.5%) eye. Posterior capsule opacification (PCO) requiring Nd: YAG laser capsulotomy developed in 13 (20%) eyes.

• CONCLUSION: Postoperative visual acuities of patients with cataract and PEX are satisfactory. However, intraoperative and postoperative complications like posterior capsule rupture, vitreous loss, conversion to ECCE, persistent corneal edema, anterior chamber reaction and IOL dislocation may be observed. To avoid these complications, proper surgical techniques and the

use of appropriate devices intraoperatively are essential.

• KEYWORDS: phacoemulsification; cataract; pseudoexfoliation syndrome; capsular tension ring; iris retractor
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INTRODUCTION

Pseudoexfoliation syndrome (PEX) is an age-related systemic disorder, in which abnormal fibrillar extracellular material is produced and accumulated in ocular tissues and the skin, liver, lungs, and other visceral organs[1-4]. Its incidence is higher in women than in men, and higher in older age groups than in younger age groups. Generally, it starts unilaterally and subsequently becomes bilateral[5]. It is associated with increased incidences of glaucoma and cataract[6]. Eyes with PEX usually exhibit insufficient mydriasis, zonular weakness and dehiscence, fibrotic capsular shrinkage, and fragile capsule[7-8]. This situation may lead to intraoperative and postoperative complications such as zonular dialysis, capsular rupture, vitreous loss, iris trauma, postoperative persistent corneal edema and inflammation in the anterior chamber, capsule contraction, intraocular pressure (IOP) increase, and IOL dislocation in cataract surgery[2,8].

In this study, we evaluated the visual outcomes and intraoperative and postoperative complications of phacoemulsification surgery in patients with cataract and PEX and the usage of proper surgical techniques and appropriate devices intraoperatively.

SUBJECTS AND METHODS

The study protocol was approved by the local ethics committee. An informed consent was obtained from the patients for the cataract surgery. The study was carried out according to the tenets of the Declaration of Helsinki. Sixty-seven eyes of 53 patients with PEX and cataract were included in this study. They had undergone phacoemulsification and IOL implantation surgery between Jan. 2009 and May 2012. Patients with previous ocular surgery, history of ocular trauma, corneal opacities, glaucoma, uveitis and posterior segment pathology and eyes with predisposition to zonular weakness and increased inflammatory response postoperatively were excluded from the study.

Their medical records were evaluated retrospectively. Their mean age was 71.68±9.96 (SD) (53-89)y, 24 (45%) were males, and 29 (55%) were females. Thirty-nine (73%) had unilateral cataracts, and 14 (27%) had bilateral cataracts. Of the 67 eyes included in the study, 33 (49%) had nuclear, 12 (18%) had cortical, 13 (20%) had posterior subcapsular, and 9 (13%) had mature cataracts. Fourteen (26%) patients had preexisting pseudoexfoliative glaucoma, and their IOPs were in the normal range with antiglaucomatous therapy. These observations are summarized in Table 1. Preoperatively, full ophthalmologic examinations were performed.

All the surgeries were performed by a single surgeon (Cetinkaya S). Under sub-Tenon's anesthesia, a 2.75 mm clear corneal incision was made. The anterior chamber was filled with a dispersive (Hydroxypropylmethylcellulose, Easy Visc, Germany) viscoelastic substance. After continuous curvilinear capsulorhexis (CCC), hydrodissection and hydrodelineation were performed, and then a side-port entrance was made. Nuclei were removed using the "stop and chop" technique (Sovereing Compact, Phacoemulsification System, AMO, USA). Cortexes were aspirated with coaxial irrigation/aspiration. Capsular bag was filled with a cohesive viscoelastic material (Na Hyaluranate 1.6, Easyluron, Germany) and a foldable monofocal posterior chamber IOL (Acriva, VSY, Turkey) was implanted in the capsular bag through an injector system. Polymethylmethacrylate (PMMA) sulcus fixation IOL was implanted in 2 eyes.

After surgery, patients used topical antibiotics (ofloxacin 0.3%, Exocin, Allergan, USA) 4 times a day and topical steroids (prednisolone acetate 1%, Pred forte, Allergan, USA) 6 times a day for 1wk, then topical steroids only, 4×1 daily for the subsequent 3wk. Also, we ordered topical antiglaucomatous therapy (dorzolamid and timolol maleate combination, Cosopt, Merck, Sharp&Dohme, USA) for 3d except the patients with preexisting glaucoma since they continued their routine antiglaucomatous therapy. Postoperatively, the patients were routinely examined after 1d, 1wk, 1mo, 3mo, 6mo, 1y, and 2y. Full ophthalmologic examinations including uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), IOP measurement, slitlamp biomicroscopic examination, and fundus examinations were performed.

Statistical Analysis All statistical analyses were performed using commercially available statistical software (SPSS version 22, SPSS Inc., Chicago, IL, USA). Data were analyzed using the Chi-square test, independent t-test and paired t-test. Statistical significance was defined as $P<0.05$.

RESULTS

In terms of gender, there was no significant difference among the patients ($P=0.392$). The frequency of nuclear cataracts was significantly higher than that of other types ($P=0.00$). The mean preoperative BCVA was 0.99±0.30 (SD) (0.40-1.50) logMAR, and the mean BCVA 1mo after surgery was 0.32±0.31 (SD) (0.00-1.00) logMAR, and this difference was statistically significant ($P=0.00$).

Intraoperatively, in 9 (13%) eyes with mature cataracts, trypan blue staining was used to facilitate capsulorhexis. Twenty-seven (40%) eyes were not dilated sufficiently despite intense use of mydriatics. A 1:10000 preparation of adrenaline was further diluted to a concentration of 1:10000 with BSS, then administered intracamerally, and additional viscoelastic substance was injected into these eyes to further dilate the pupils. However, in 7 (10%) eyes, iris hooks were used to stretch the pupils, and in 12 (18%) eyes iris

Table 1 Characteristics of the patients

Characteristics	Mean±SD(range $n=53$); Number (percentage)
Age (a)	71.68±9.96 (range 53-89)
Sex	
M	24 (45%)
F	29 (55%)
Laterality	
Unilateral	39 (73%)
Bilateral	14 (27%)
Type of cataract	
Nuclear	33 (49%)
Cortical	12 (18%)
Posterior subcapsular cataract	13 (20%)
Mature	9 (13%)
Preexisting glaucoma (Number of patients)	14 (26%)

retractors (0.17×10 mm, Liberty, USA) were used for mydriasis. Postoperatively, in 4 (6%) eyes there were minor sphincter ruptures, and persistence of mydriasis lasted for 1mo in 2 (3%) eyes. One month after the surgery, all the pupils were round, symmetric, and reactive to light.

Because of preoperative phacodonesis and iridodonesis, we planned to implant CTRs (12 mm, Liberty, USA) in 8 (12%) eyes, and during the surgery 7 (10%) more eyes required CTR implantation due to zonular weakness and dehiscence. A total of 15 CTRs (22%) were implanted, 10 (67%) after hydrodissection and 5 (33%) after nucleus emulsification. Additionally, in 5 (33%) of these patients' iris retractors were also used for mydriasis. Posterior capsule rupture occurred in 4 (6%) eyes, with vitreous loss present in 2 (3%) of these, requiring anterior vitrectomy. CTR could not be placed into these eyes, due to posterior capsule rupture. In these 2 (3%) eyes, conversion to extracapsular cataract extraction was needed due to large posterior capsular rupture. PMMA sulcus fixation IOLs were implanted into these 2 eyes (3%). No nucleus drop occurred.

Persistent corneal edema was observed in 4 (6%) eyes postoperatively and lasted for 1mo, but with intense topical steroid therapy it resolved. Anterior chamber reaction exhibiting a 3+ cell count, 2+ flare, and fibrinous reaction occurred in 5 (7%) eyes, and with intense topical steroid therapy the inflammation ceased within 6wk. No postoperative IOP spikes were observed in any patients.

Postoperatively, IOL dislocation occurred in 4 (6%) eyes. In 3 patients this decentration was slight, and did not cause monocular diplopia complaints. However, in 1 (1.5%) patient, decentration was more prominent and the patient reported monocular diplopia, thus we repositioned the IOL surgically, which solved the problem. In long-term follow-up the IOLs remained stable in these patients, and no further progression of decentration occurred. In 1 (1.5%) patient, CTR dislocation towards the anterior chamber was observed. It was repositioned surgically, and in long-term follow-up there was no problem with that patient. Posterior capsule opacification (PCO) developed in 13 (20%) eyes up to 2y following the surgery, out of these 13 eyes, 3 were in CTR-implanted group and 10 were in non-CTR-implanted group. In terms of PCO, there was no statistically significant difference between two groups ($P=0.874$). Nd:YAG laser capsulotomy was applied to these eyes. These patients had no other problems throughout their further follow-up periods. We did not observe any complications related to Nd:YAG laser capsulotomy like damage to IOL, IOP elevation, macular edema and retinal detachment.

All the intraoperative and postoperative complications described above are summarized in Table 2.

DISCUSSION

PEX is a challenge faced by cataract surgeons, and is associated with a higher incidence of both intraoperative and postoperative complications such as insufficient mydriasis, zonular weakness and dehiscence, capsule contraction, posterior capsular rupture, vitreous loss, iris trauma, iris sphincter dysfunction, postoperative IOP rise, persistent corneal edema, increased inflammation, subluxation or luxation of IOL with the lens capsule, and increased incidence of PCO[9-12].

Poor pupillary dilatation is frequently encountered in cases of PEX, and this situation may increase intraoperative complications. Pharmacological agents like adrenaline, additional viscoelastic use, sphincterectomy, surgical iris incisions, stretching with iris hooks, iris retractors, and pupil-dilator rings may be used to achieve adequate pupil dilatation[13-15]. In our study, twenty-seven (40%) eyes were not dilated sufficiently despite intense use of mydriatics, we used adrenaline (diluted to 1∶10000), additional viscoelastic substance, iris stretching hooks, and iris retractors to provide mydriasis.

The most common type of cataract seen in patients with PEX is nuclear cataract, and the incidence of mature cataract is also high in PEX[6,16]. To ensure the safety of capsulorhexis, trypan blue staining may be used in white, mature cataracts[17]. We also used trypan blue staining in 9 (13%) eyes with mature cataracts.

Table 2 Frequency of intraoperative and postoperative complications

Complications	Frequencies, $n=67$ (Number of eyes, %)
Insufficient mydriasis	27 (40%)
1:10000 Adrenaline administration and additional viscoelastic use	27 (40%)
Stretching with iris hooks	7 (10%)
Use of iris retractors	12 (18%)
Postoperative sphincter rupture	4 (6%)
Persistent mydriasis (sphincter dysfunction)	2 (3%)
Trypan blue staining	9 (13%)
Posterior capsule rupture	4 (6%)
Anterior vitrectomy	2 (3%)
Nucleus drop	0 (0%)
Planned CTR implantation	8 (12%)
Unplanned CTR implantation	7 (10%)
Total CTR implantation	15 (22%)
Iris retractor use and CTR implantation, together	5 (7%)
Conversion to ECCE	2 (3%)
Postoperative persistent corneal edema	4 (6%)
Postoperative IOP spikes	0 (0%)
Postoperative anterior chamber reaction (cell, flare, and fibrinous reaction)	5 (7%)
IOL dislocation	4 (6%)
Repositioned IOL	1 (1.5%)
CTR dislocation	1 (1.5%)
Repositioned CTR	1 (1.5%)
PCO	13 (20%)

CTR: Capsular tension ring; ECCE: Extracapsular cataract extraction; IOP: Intraocular pressure; IOL: Intraocular lens; PCO: Posterior capsular opacification.

Surgical trauma may increase zonular dehiscence; therefore, capsulorhexis must be performed carefully. Other maneuvers including hydrodissection, removal of the nucleus, epinucleus, and cortex must also be performed carefully, otherwise zonular weakness may lead to zonular dialysis. Additionally, the capsulorhexis diameter should be large enough to reduce capsular fibrosis. In cases of zonular weakness or dehiscence, CTR implantation distributes the applied forces circumferentially and maintains the circular contour of the capsular bag after cataract removal, and stabilizes the capsule throughout the surgery, thus minimizing the risk of potential intraoperative complications such as zonular dialysis, posterior capsule perforation, vitreous loss, and nucleus drop. By inhibiting lens epithelial cell migration, CTR also prevents late decentration and postoperative IOL dislocation[18-19]. However, the lens zonules of eyes with PEX weaken progressively after cataract surgery. Postoperative IOL dislocation may occur thereafter, but since a CTR can reduce anterior capsule contraction, it may contribute to the prevention of IOL dislocation in eyes with a slight zonular decline[20-22]. Therefore, patients should be made aware that despite CTR implantation, IOL dislocation may occur any time following the surgery. In our patients, we also used CTR in 15 (22%) eyes and after the operation IOL dislocation developed in 4 (6%) eyes, but IOL repositioning was only required in 1 case. For extensive zonular weakness, modified CTRs can be sutured to the sclera[18].

Ostern *et al*[23] reported that 6-7y after cataract surgery, the intraocular lenses within the capsular bag are more prone to decentration in eyes with PEX, compared to controls (cataract without PEX). Shingleton *et al*[24] analyzed the outcomes of surgery for dislocated IOL in patients with pseudoexfoliation. They reported that IOL exchange operations were performed in 64 eyes (79%), and IOL repositioning was performed in 17 eyes (21%). The corrected distance visual acuity improved in all eyes.

Hayashi *et al*[25] reported that corneal endothelial cell loss and a transient increase in central corneal thickness (CCT) were greater after cataract surgery in eyes with pseudoexfoliation than in eyes without pseudoexfoliation . On the other hand, Ostern and Drolsum[26] reported that 6-7y following cataract surgery, no statistically significant differences were established in endothelial cell density (ECD), pleomorphism, polymegathism, or corneal thickness in eyes with and without PEX.

Even though CTR has been shown to reduce PCO incidence, PCO requiring YAG laser capsulotomy is not uncommon, which may be due to the difficulty of achieving complete clearance of the cortex due to the presence of the CTR[19,27]. Notably, PEX itself increases the incidence of posterior capsule opacity after cataract surgery. In our study, the rate of PCO requiring YAG laser capsulotomy was 20%. In terms

of PCO, there was no statistically significant difference between CTR-implanted and non-CTR-implanted groups. And we did not observe any complications related to Nd:YAG laser capsulotomy like damage to IOL, IOP elevation, macular edema and retinal detachment.

Takmaz *et al*[4] reported that complication occurrence rate (posterior capsular rupture, vitreous loss and/or zonular dehiscence) was more in eyes with PEX than eyes without PEX.

Sufi *et al*[12] reported that patients with PEX were significantly older, had harder cataract, zonular dehiscence and higher postoperative inflammatory response in comparison with the patients without PEX (control group).

In conclusion, postoperative visual acuities of patients with cataract and PEX are satisfactory, however, intraoperative and postoperative complications like posterior capsule rupture, vitreous loss, conversion to ECCE, persistent corneal edema, anterior chamber reaction and IOL dislocation may be observed. To avoid these complications, proper surgical techniques and the use of appropriate devices intraoperatively are essential.

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