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Intraoperative and postoperative complications of phacoemulsification in cataract eyes with pseudoexfoliation syndrome

Оперативне и постоперативне компликације факоемулзификације код пацијената са катарактом и псеудоексфолијационим синдромом

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SUMMARY

Introduction/Objective Pseudoexfoliation syndrome (PEX) is an age-related systemic disorder characterized by deposition of fibrillary white flaky material mainly on the lens capsule, corneal endothelium, zonules, ciliary body, iris and pupillary margin. Zonular weakness progressively increases along with the hardness of the lens, patient's age and the presence of glaucoma.
To compare the intraoperative and postoperative complications of phacoemulsification in cataract eyes with PXF syndrome with cataract eyes without PEX.
Methods The study enrolled 300 eyes with consequently operated senile cataract and PEX and 300 consequently operated eyes with cataract without PEX who underwent phacoemulsification performed by one experienced surgeon (single surgeon series). To all patients, the complete ophthalmological examination was performed preoperatively, the first, 7^{th} and 180^{th} day postoperatively.
Results The significant statistical differences between observed groups were the following: patients with PXF were older (74.2± 8.0; range 56-82 years vs. 68.1± 9.6; range 56-79 years) had smaller pupil diameter and higher intraocular pressure (IOP) preoperatively (16.1±4.1 vs. 13.8±3.7 mmHg). There were no differences between groups regarding intraoperative complications. Early postoperatively complications were significant rise of IOP (33 vs. 6 patients; p<0.001), more often postoperative corneal edema (36 vs. 21 patients; p<0.036) and anterior chamber inflammation (17 vs. 7 patients; p<0.037) in PEX group comparing to the control group. The significant late postoperative complication was elevated IOP (24 vs.5 patients; p<0.0002) in patients with PEX.
Conclusion In the hands of an experienced and careful surgeon, phacoemulsification is a safe and beneficial surgery to treat cataract with associated pseudoexfoliation. The greatest problem a surgeon faces is a narrow pupil and zonule instability and to recognizing eyes that are particularly at risks such as having glaucoma and phacodonesis.

Key words: phacoemulsification, pseudoexfoliation syndrome, senile cataract

САЖЕТАК

Увод/Циљ Псеудоексфолијациони синдром (ПЕХ) представља системски поремећај који се јавља у старијем животном добу а карактерише се наслагама љуспастог материјала на предњој капсули сочива, ендотелу рожњаче, дужици, зонулама, цилијарном телу, ирису и пупиларном рубу. Прогресивна слабост зонула заједно са вежом тврдоћом очног сочива, старост и присуство глаукома је чешће код пацијената са ПЕХ.
Упоредити оперативне и постоперативне компликације факоемулзификације код пацијената са катарактом који имају ПЕХ у односу наоне који немају ПЕХ.
Методе Студија је обухватила 300 узастопно оперисаних очију са сенилном катарактом и ПЕХ и 300 узастопно оперисаних очију са сенилном катарактом без ПЕХ а који су оперисали катаракту факоемулзификацијом од стране једног хирурга. Свим пацијентима је рађен комплетан офталмолошки преглед преоперативно, првог, седмог и 180.дана после операције.
Резултати Значајна статистичка разлика између посматраних група преоперативно је постојала у следећем: болесници са ПЕХ су били старији (74.2±8.0; тј. 68.1±9.6 година), имали су мањи дијаметар пупиле и виши интраокуларни притисак (ИОП, 16.1±4.1 тј. 13.8±3.7 mmHg). У току операције, није било значајних разлика у врсти компликација. Ране постоперативне компликације су биле: значајан раст ИОП (33 тј. 6 болесника; p<0.001), чешћи налаз корнеалног едема (36 тј. 21 болесника; p<0.036) инфламације у предњој очној комори (17 тј. 7 болесника; p<0.037). У касном постоперативном периоду значајно је чешћи био налаз пораста ИОП-а у групи са ПХФ (24 тј. 5 болесника; p <0.0002).
Закључак У рукама искусног и пажљивог хирурга, факоемулзификација је безбедна и корисна хируршка метода код болесника са сенилном катарактом и ПЕХ. Највећи проблем представља уска зеница, зонуларна нестабилност и правовремено препознавање факодонезе и глаукома код пацијената са ПЕХом.

Кључне речи: факоемулзификација; псеудоексфолијациони синдром; сенилна катаракта

INTRODUCTION

Pseudoexfoliation syndrome (PEX) is an age-related systemic disorder characterized by the presence of fibrillar material that targets all ocular tissue such as lens and iris pigment epithelium, lens capsule, ciliary body, zonules, corneal endothelium and iris but also involving organs other than the

eye [1,2]. Whitish dusty deposits (fibrillary residue) can be observed on the anterior lens capsule, pupillary margin, corneal endothelium, along Schwalbe's line and trabecular meshwork, on the zonules and vitreous body. Although the understanding of this disease has increased considerably, the exact etiology and the structure of the pseudoexfoliative material is still unknown. [3]. It may a generalized disorder involving abnormal production or turnover of extracellular matrix in the basement membrane [1,3]. Patients with PEX demonstrated significantly higher zinc and copper levels in aqueous humor, the higher copper content of lenses as well as higher levels of iron and copper in serum were significantly increased in PEX group compared to cataract patients without PEX [4]. There are some reports indicated that infrared radiation contributed capsular delamination [5].

It has been believed for many years that cataract surgery in patients with PEX carries an increased risk of intraoperative and postoperative complications, thus requiring additional caution and presenting a challenge to the surgeon, especially when extracapsular cataract surgery was performed [6]. Some authors reported a lower rate of intraoperative and postoperative complications when compared outcome of modern phacoemulsification with the extracapsular cataract extraction technique [7,8].

As phacoemulsification surgical technique using ultrasound technology has been the most commonly performed cataract procedure in recent years, the results of this method in patients with PXF have been the subject of many studies. The reports of authors on the incidence of intraoperative and postoperative complications in the eyes with PEX are rather controversial. A few studies that analyzed the results after phacoemulsification cataract surgery indicate that during the surgery certain problems occur due to poorly dilated pupils, weak zonulae, and fragile anterior lens capsule, resulting in increased percentage of complications in these eyes [8–10]. A few recent studies show that phacoemulsification cataract surgery in patients with PXF is a more complicated surgery compared to cataract surgery in a non-PEX eye, but if performed by an experienced surgeon it does not present a significantly higher risk for the patients [11,12].

The aim of this study is to compare the intraoperative and postoperative complications of phacoemulsification in cataract eyes with PEX syndrome with cataract eyes without PEX.

METHODS

In total, 600 eyes with senile cataract that underwent phacoemulsification with implantation of intraocular lenses were included in this study. Patients were divided into two groups: the first group was the group with senile cataract and PEX (300 eyes) and the second, control group (300 eyes) were senile cataract patients without PEX. Phacoemulsification was performed by one surgeon in the period from May 2005 to January 2011 at the Ophthalmology Clinic of the Clinical Center Niš.

Exclusion criteria were a traumatic cataract, high values of intraocular pressure in patients requiring a previous antiglaucomatous surgery, uncontrolled diabetes and acute cardiovascular events

(hypertension resistant to therapy, arrhythmia etc.). The complete ophthalmologic examination was done preoperatively,1st and 7th day and 6 months after the cataract surgery.

All the surgeries were performed using the apparatus Millennium Bausch&Lomb with "burst" mode and implantation of hydrophilic acrylic flexible lenses. In all the patients local peribulbar anesthesia was performed, with corneal incision of 3mm and application of cohesive viscoelastic for performing continuous capsulorhexis.

Student's t-test and chi-square test were used for statistical analyzes of clinical demographic characteristics and frequency of operative complications.

RESULTS

Phacoemulsification was performed in 600 eyes with senile cataract. The group of patients with PEX syndrome comprised 180 female and 120 male patients with mean age of 74.2±8.0 years (range 56–82 years) and the control group of patients with senile cataract without PXF included 170 female and 130 male patients with mean age of 68.1± 9.6 years (range 56–79 years). The patients in the group with cataract associated with PEX were significantly older in comparison to the control group ($p<0.01$) but there is no difference in sex distribution ($p=0.793$).

Pupil diameter and intraocular pressure (IOP) were measured preoperatively. None patients had phacodonesis or lens dislocation. Mentioned parameters could affect the surgery outcome. Patient in control group preoperatively demonstrated a lower IOP, bigger pupil diameter what was significant difference comparing to the senile cataract group with PEX who had statistically significantly higher frequency of elevated IOP (≥ than 22 mmHg) (table 1).

Table 1. Preoperative clinical findings in cataract patients with and without PEX

Clinical findings	Senile cataract with PEX (n= 300 eyes)	Senile cataract without PEX (n=300 eyes)	*p*
Intraocular pressure (mmHg)	16.1±4.1	13.8±3.7	<0.001
Pupil diameter*	105(35.0%)	38(12.6%)	<0.001
Elevated IOP	30(10.0%)	14(4.70%)	<0.012

* Pupil diameter was consider as having pupil diameter less then 5 mm.

Table 2. Intraoperative complications in cataract patients with and without PEX who underwent phacoemulsification

Complications	Senile cataract with PEX (n=300 eyes)	Senile cataract without PEX (n=300 eyes)	*p*
Incomplete capsulorhexis	9(3%)	3(1%)	0.080
Posterior capsule rupture	3(1%)	1(0.35%)	0.315
Zonular rupture	3(1%)	2(0.7%)	0.563
Vitreous body prolapse	3(1%)	1(0.35%)	0.315
Hyphaema	1(0.35%)	0(0%)	0.316
Residual lens masses	3(1%)	1(0.35%)	0.315

In table 2 were listed intraoperative complications in both groups. As it has been shown, there is no statistically significant difference between observed groups regarding incomplete capsulorhexis, zonular rupture and vitreous body prolapsed. To all patients with posterior capsule rupture, the anterior chamber lens implantation was performed.

The patients were postoperatively followed for 6 months. Detailed findings are shown in tables 3. and 4. presenting early and late postoperative complications (7th and 180th postoperative day).

As it has been shown in table 3, patients with PEX demonstrated the significant rise of IOP and more often postoperative corneal edema and anterior chamber inflammation comparing to the control group in early postoperative period.

Table 3. Early postoperative complications in cataract patients with and without PEX who underwent phacoemulsification (7th day postoperatively).

Complications	Senile cataract with PEX (n=300 eyes)	Senile cataract without PEX (n=300 eyes)	*p*
Corneal edema	36(12%)	21(7%)	**0.036**
Elevated IOP	33 (11%)	6 (2%)	**<0.001**
Anterior chamber inflammation	17 (5.7%)	7(3.3%)	**0.037**
Fibrinous exudation	5 (1.7%)	3(1.0%)	0.476
Hyphema	2(0.7%)	0(0.0%)	0.156
Lens dislocation	3(1.0%)	0(0.0%)	0.082
Cystoid macular edema	5(1.7%)	2(0.7%)	0.254

Table 4. Late postoperative complications in cataract patients with and without PEX who underwent phacoemulsification (180 day postoperatively).

Complications	Senile cataract with PEX (N 300 eyes)	Senile cataract without PEX (N 300 eyes)	*p*
Postoperative keratopathy	2(0.7%)	1(0.35%)	0.562
Elevated IOP	24(8%)	5(1.7%)	**0.0002**
Lens dislocation	3(1.0%)	0 (0.0%)	0.082
Posterior capsule opacification	7(2.3%)	5(1.7%)	0.559
Anterior capsular constriction	2(0.7%)	0(0.0%)	0.156
Macular edema	1(0.3%)	0(0.0%)	0.316

Six months postoperatively, in the group with PEX, was found that 24 patients still having glaucoma, but the number is significantly reduced (p 0.01) in comparison to preoperative findings (n=30 patients) (table 4).

DISCUSSION

The patients with pseudo-exfoliation syndrome were significantly older, had smaller pupil diameter and higher IOP than controls. These findings are similar to recently published results [13]. Out of total 300 patients with cataract and pseudoexfoliation syndrome, 30 (10%) of them had capsular glaucoma, what is statistically significantly more frequent than in controls. Mean values of intraocular pressure were higher in the group with PEX, which correlates with the results from other studies and at the same time justifies the attitudes that in patients with elevated values of intraocular pressure in preoperative management treatment strategies should be directed at reducing IOP with medical therapy.

In 105 patients with cataract and pseudoexfoliation pupils were less than 5mm in diameter despite administration of two mydriatics, which imposes a significant problem to the surgeon because it makes the properly sized capsulorhexis more difficult to perform. Apart from the problems concerning capsulorhexis performance, other phases of the surgery are also challenging, considering the tendency of subsequent narrowing of the pupil during the surgery.

In practice, small sized pupils can be enlarged by high-density viscoelastic agents to perform viscomydriasis, and by the use of iris retractors in order to perform properly sized capsulorhexis. A

very important stage in performing ultrasound cataract surgery is the continuous curvilinear capsulorhexis which has been considered of great importance, especially in the eyes with pseudoexfoliation, zonule laxity, and anterior capsule fragility. In these patients irregular capsulorhexes and uncontrolled anterior capsule tears that may compromise surgery course have often been described. We performed anterior capsule staining in most patients and achieved significantly better visualization, enabling the surgeon to work more safely and comfortably. Nevertheless, 3% of patients with PEX had incomplete capsulorhexis, which is slightly higher incidence in comparison to the controls. Posterior capsule rupture occurred during lens chopping and anterior chamber intraocular lens was implanted in 3 cases with PEX and 1 case without PEX. Wong et al.reported the similar experiences in senile cataract eyes with true exfoliative syndrome [14].

Zonular weakness or laxity is one of the important features in patients with PEX, requiring extreme caution and precision during the procedure. In our group of patients with pseudoexfoliation and cataract, there were no cases of zonular dialysis preoperatively while 3 patients manifested zonular weakness during the surgery. All the patients underwent "burst" technique for phacoemulsification, our preferred technique over the “pulse” mode, which means less ultrasound energy use. It is recommended to use adjunctive pupil and zonule support devices [15]. Anterior capsular snap over the capsulorhexis edge has been described as a sign of zonular dehiscence and instability [16].

It is of extreme importance to minimize the risk of zonular dialysis occurrence during emulsification the lens nucleus that can be of the greater degree of hardness in some cases. In most patients we used "Phaco quick" technique (85%), "stop and chop" technique in 15%, and "divide and conquer" technique in 5% of cases. The preference was given to the technique that enables faster and more effective nuclear fragmentation, but basically, the recommended technique is the one the surgeon is most comfortable with.

In the phase of viscoelastic aspiration, it is extremely important to completely remove viscoelastic substance used in the previous phase of lens implantation since even small residue may result in transitory elevation of intraocular pressure.

Early postoperative complications most commonly include postoperative corneal edema and transitory ocular inflammation signs. Zhang and Saheb [17] reported that endothelial cell density (ESD) is lower in cataract patients with PEX preoperatively and corneal cell loss is greater postoperatively. They reported a transient increase in central corneal thickness after cataract surgery in eyes with PEX than in eyes without PEX, too.

Lens dislocation and anterior capsular constriction more commonly occur in patients with pseudoexfoliation mostly as the consequence of frequent postoperative inflammation and a smaller capsulorhexis resulting from the narrow pupil.

IOP control in the early postoperative period seems to be important in patients with PEX who underwent cataract surgery [18] It was shown that a long-term reduction in mean IOP occurred in

PEX eyes with and without glaucoma preoperatively suggesting a protective effect of phacoemulsification on IOP in these eyes [19]. Also, preoperative diagnosis of glaucoma seems to be the only factor to affect the higher postoperative IOP [20]. There were no differences in complications between eyes with PEX and fellow eyes without PEX [21].

CONCLUSION

In our experience, phacoemulsification method can be safely performed in cataract patients with PEX. It is challenging surgery but careful preoperative planning and intraoperative care could ensure a successful outcome and safe procedure. Concerning the numerous complications that may occur in these patients, we did not face severe intraoperative complications apart from certain problems in performing capsulorhexis.

By understanding all the specific ocular features in patients with pseudoexfoliation, proper preoperative preparation, application of suitable technique and surgeon's experience, the optimal outcome can be achieved in patients with senile cataract and PEX. Postoperative 1-month follow-up period is of great importance to timely prevent and observe possible complications such as assess endothelial cell function, glaucoma screening etc. The risks associated with cataract surgery in the PEX patient can be minimized with the proper preoperative, intraoperative and postoperative care.

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