DOI: 10.7860/JCDR/2014/10004.5277

Original Article

Ophthalmology Section

Intraoperative and Immediate Postoperative Outcomes of Cataract Surgery using Phacoemulsification in Eyes with and without Pseudoexfoliation Syndrome

NEELAM R DWIVEDI[1], ARUN K DUBEY[2], P RAVI SHANKAR[3]

ABSTRACT

Background: To compare the intraoperative and immediate postoperative behavior and complications in eyes with pseudoexfoliation (PEX) syndrome with eyes having senile cataract without PEX during cataract surgery using phacoemulsification (PKE).

Materials and Methods: In this prospective study, 68 eyes of 68 patients were divided into two groups: Group 1 (test) comprised 34 eyes with immature senile cataract with PEX and Group 2 (control) included 34 eyes with immature senile cataract without PEX and any coexisting ocular pathology.

Phacoemulsification (modern cataract surgery) was performed on both groups through stop and chop technique and comparative analysis of the incidence of intraoperative and immediate postoperative complications was made.

Results: There was no significant difference in rates of intraoperative complications between PEX (2.9%) and Control (0%) group. The mean pupil diameter was significantly smaller in Group 1 ($p<0.001$). No eye in either group had phacodonesis. 58.8% of eyes in Group 1 and 29.4% in Group 2 had a harder cataract (nuclear sclerosis) ≥ grade 3 ($p=0.017$). PKE was performed in all eyes with cataract in both groups. Intraoperative complication (zonular dialysis (dehiscence) was encountered in only 2.9% (1 case) of eyes with PEX. PC (posterior capsule) tear (rent) with vitreous loss was seen in 2.9% eyes of Group 1 and none in Group 2. Postoperatively, IOP (intraocular pressure) and aqueous flare response were comparable between the groups. Significantly higher inflammatory cell response was observed in Group 1 ($p=0.014$). BCVA (best corrected visual acuity) using Snellen chart with pinhole on postoperative day1 was significantly better in the control group compared to the group with PEX ($p=0.027$).

Conclusion: Phacoemulsification can be safely performed by experienced hands in cataractous eyes with PEX. The incidence of intraoperative and immediate post-operative complications in eyes with PEX was not significantly different compared to eyes without PEX in our study. Further studies among a larger population are required

Keywords: Cataract surgery, Phacoemulsification, Pseudoexfoliation syndrome

INTRODUCTION

Pseudoexfoliation (PEX) is an age-related abnormal fibrillopathy characterized by gradual synthesis, accumulation and deposition of exfoliation material in the anterior segment of the eye and other tissues of the body [1]. This deposition of material may lead to characteristic clinical and ultrastructural changes of the lens epithelium/capsule [2] (PEX syndrome phacopathy) or intraocular lens (IOL), corneal endothelium [3] (PEX syndrome corneal endotheliopathy), trabecular meshwork [4] (capsular glaucoma), iris [5] (PEX syndrome iridopathy), ciliarybody [6] (PEX syndrome cyclopathy), zonules [7] (PEX syndrome zonulopathy), and structures of the blood- aqueous barrier (blood- aqueous barrier breakdown) [5]. These alterations of tissues of the anterior eye segment make cataract surgery (phacoemulsification) potentially challenging and surgeons must be aware of numerous intraoperative and postoperative complications in managing the patient with PKX syndrome.

Serious complications caused mainly by "phakopathy" and "zonulopathy" or zonular weakness have been reported [8-10]. Weakened zonules may manifest clinically with iridodonesis, phacodonesis, anterior chamber depth asymmetry, and even spontaneous lens subluxation or dislocation [11]. Intraoperatively, eyes with PEX are at greater risk for zonular dialysis, posterior capsule tear/rent, vitreous loss, and dropped nucleus or fragment; postoperatively, they have a higher incidence of inflammation in the form of increased aqueous flare and cell response, fibrin reaction, posterior synechias, posterior capsule opacification, anterior capsule phimosis, and late intraocular lens (IOL) decentration and dislocation [12-14]. These complications are mainly believed to be caused by surgical trauma resulting from iris vessel pathology and an insufficiently dilated pupil [5,7].

Phacoemulsification (PKE) has become the norm for routine cataract surgery. In eyes with PEX, the lens tends to be harder and requires increased emulsification time, which can result in more difficult surgery. In addition, with this technique, pressure on the capsular–zonular diaphragm may stretch the capsule and zonules, thereby increasing the risk for zonular/capsular tear and vitreous loss [15]. Recent studies performed by experienced surgeons observing the risk of complications in PEX in cataract surgery have shown a lower rate compared with earlier studies that showed up to a 10-fold increase [14,15].

Despite the increased risks, with the use of a combination of appropriate devices, improvement in PEX technologies and approaches, the overall outcomes for patients with PEX undergoing cataract surgery can be similar to those for non-PKE patients [16,17].

Hence, we designed the prospective study to evaluate the outcomes of PKE in the eyes of Indian patients with PKE syndrome and in normal eyes with senile cataract and no coexisting pathology. We report results comprising intraoperative observations and immediate postoperative (day 1) behaviour.

Parameter	Group 1 (PEX) (n=34)	Group 2 (control) (n= 34)	p-value
Age (years)	69.41 + 7.53	56.62 + 9.64	<0.001
Number of males (%)	27 (79.4%)	18 (52.9%)	0.039
UCVA	0.076 + 0.047	0.10 + 0.06	0.041
BCVA	0.16 + 0.09	0.17 + 0.08	0.449
ACD(mm)	3.24 + 0.28	2.97 + 0.16	<0.001
Axial length (mm)	23.03 + 0.69	22.77 + 0.75	0.146
Intraocular pressure (mmHg)	14.29 + 2.92	15.23 + 1.63	0.107
Nuclear sclerosis Cataract grade n (%)	Grade 1-2 = 14 (41.2) Grade 3 = 15 (44.1) Grade 4 or 5 = 5 (14.7)	Grade 1-2 = 22 (64.7) Grade 3 = 6 (17.6) Grade 4 or 5 = 4 (11.8)	0.017
Posterior capsular cataract Cataract grade n (%)	Grade 0 = 15 (44.1) Grade 1 = 11 (32.4) Grade 2 = 7 (20.6) Grade 3 = 1 (2.9)	Grade 0 = 10 (29.4) Grade 1 = 9 (26.5) Grade 2 = 11 (32.4) Grade 3 = 2 (5.9) Grade 4 = 2 (5.9)	0.352
Cortical cataract Cataract grade n (%)	Grade 0 = 25 (73.5) Grade 1 = 6 (17.6) Grade 2 = 3 (8.8)	Grade 0 = 33 (97.1) Grade 1 = 1 (2.9)	0.022

[Table/Fig-1]: Comparison of preoperative parameters between the test and the control group
PEX – pseudoexfoliation; ACD- anterior chamber depth; UCVA- uncorrected visual acuity; Preop- preoperative; BCVA – best corrected visual acuity with pin hole
Decimal conversion of Snellen values was used for visual acuity

Parameter	Group 1 (PEX) (n=34) No. of eyes (%)	Group 2 (control) (n=34) No. of eyes (%)	p-value
Mean pupil diameter (mm)	5.40 + 0.88	6.83 + 0.50	<0.001
CCC size	4.87 + 0.58	5.97 + 0.27	<0.001
Phaco power	25.88 + 7.19	26.79 + 5.73	0.565
Phaco time (sec)	49.70 + 13.75	40.20 + 10.27	0.002
Posterior capsular tear with / without vitreous loss	1 (2.9)	none	1.00
Zonular dehiscence	1 (2.9)	none	1.00
Sulcus IOL	1 (2.9)	none	0.357
Anterior chamber IOL	1 (2.9)	none	0.357
Intraoperative posterior capsular plaque	1 (3)	none	0.493

[Table/Fig-2]: Intraoperative observations among the two groups
CCC- continuous curvilinear capsulorhexis; IOL- intraocular lens

MATERIALS AND METHODS

In this prospective study conducted at ICARE Eye hospital Noida, India, 68 eyes of 68 patients were separated into two groups: Group 1 (Test) comprised 34 eyes having immature senile cataract with PEX and Group 2 (Control), had 34 eyes with immature senile cataract without PEX. All patients provided written informed consent. All procedures followed in the study were in accordance with ethical standards set forth by the Institutional Review Committee.

The study was conducted among patients attending free eye camps organized by the institution in Northern India. Detailed pre-operative examination of the patients was carried out and patients with PEX and meeting the inclusion criteria were placed in test group 1 while patients with senile cataract without PEX were placed in group 2. A convenience sample of patients was taken and the number was matched between the two groups.

The inclusion criteria in Group 1 (PEX) were cataract with or without a white pupillary ruff and the presence of a manifest classic (late stage) pseudoexfoliation deposition pattern in the anterior lens capsule. The pattern consisted of a central grey disc, midperipheral clear ring and peripheral gray rim of pseudoexfoliative material. Group 2 comprised normal eyes with senile cataract and the absence of coexisting ocular pathology.

Mature cataract, complicated cataract, previous ocular surgery, history of ocular trauma, corneal opacities, glaucoma, uveitis and

	Group 1(PEX) (n=34) No. of eyes (%)	Group 2(control) (n=34) No. of eyes (%)	p Value
AC flare	Grade 1 = 3 (8.8) Grade 2 = 25 (73.5) Grade 3 = 6 (17.6)	Grade 1 = 2 (5.9) Grade 2 = 31 (91.2) Grade 3 = 1(2.9)	0.110
AC cells	Grade 1 = 10 (29.4) Grade 2 = 22 (64.7) Grade 3 = 2 (5.9)	Grade 1 = 20 (58.8) Grade 2 = 10 (29.4) Grade 3 = 4 (11.8)	0.014
Corneal oedema	Clear = 22 (64.7) Mild = 7 (20.6) Moderate = 5 (14.7)	Clear = 29 (85.3) Mild = 5 (14.7) Moderate = none	0.043
Fibrin in AC	Absent = 30 (88.2) Present = 4 (11.8)	Absent = 31 (91.2) Present = 3 (8.8)	1 .00
POSTOP IOP (mmHg)	14.35 + 4.71	13.82 + 2.57	0.568
VA POD1	0.29 + 0.13	0.39 + 0.14	0.002
POSTOP day 1 BCVA	0.42 + 0.19	0.58+ 0.20	0.002

[Table/Fig-3]: Day 1 postoperative outcomes among patients in the test and the control group
AC - anterior chamber; IOP intra ocular pressure; VA POD 1 - visual acuity postoperative day 1; BCVA- best corrected visual acuity with pinhole
Decimal conversion of Snellen values was used for visual acuity

posterior segment pathology and eyes with predisposition to zonular weakness and increased inflammatory response postoperatively were the exclusion criteria for both groups.

All patients underwent a preoperative eye examination including clinical history and systemic examination, measurement of visual acuity using Snellen chart, intraocular pressure (IOP) by Goldmann applanation tonometry and central anterior chamber depth by A-scan biometry. A-scan biometry was also used to measure the power of the cornea (keratometry) and axial length of the eye, and using this data to determine the ideal intraocular lens power. Decimal conversion of Snellen's chart values was used. Detailed slit lamp biomicroscopy under maximal mydriasis was performed to assess pseudoexfoliative material deposition on the anterior lens capsule, type and grade of cataract, and the presence of phacodonesis or zonulolysis. A detailed fundus examination was conducted. All observation and demographic data were carefully recorded using a protocol sheet.

Age in years, uncorrected visual acuity, best corrected visual acuity, anterior chamber depth, axial length, intraocular pressure, grade of cataract were compared among the test group (with PEX) and the control group using independent samples (unpaired) Student's t-test ($p<0.05$) as the data was normally distributed.

Surgical technique: PKE was performed under peribulbar anaesthesia. All cases were operated on by a single surgeon. Pupillary dilatation was achieved and maintained by instillation of 1% tropicamide, 10% phenylephrine and 0.03% flurbiprofen before surgery. Anaesthesia and akinesia was achieved by peribulbar injection of 2% lignocaine with adrenaline (1: 20, 0000) and 0.5% bupivacaine.

After constructing a 5.2 mm long scleral tunnel, anterior continuous curvilinear capsulorhexis (CCC) was fashioned through a stab wound at 11'0 clock position using cystitome. The size of CCC was measured using the same method as for pupil size. In brief; the pupil and CCC were viewed on a flat 51 cm television screen and measured in centimeters with a transparent ruler under a microscopic magnification of 10. A table was used to convert the measurements in centimeters to the actual size in millimeters [18].

After entering the anterior chamber with a sharp 2.8 mm keratome, careful hydrodissection was performed to free the cataract from the capsular attachments without putting any stress on the zonules. After completion of hydrodissection procedures, complete nuclear rotation was performed as free nucleus rotation minimizes the stress on zonules during PKE. The nucleus was emulsified using standard stop and chop technique [19]. Following automated

irrigation-aspiration for cortical removal and PC polishing, a single piece polymethylmethacrylate (PMMA) rigid, 5.25 size intraocular lens (IOL) was inserted in the bag. Methylcellulose 2% was the viscoelastic substance used in all cases. Subconjunctival injection of Gentamicin and Dexamethasone was done at the conclusion of the surgery. Difficulty in performing CCC, phacodonesis, zonular dialysis and phacoparameters (phaco time, phaco power) were documented intraoperatively on the protocol sheets.

During surgery, mean pupil diameter in millimeters, CCC size, phaco power, phaco time, and incidence of complications during surgery were compared among the two groups using independent samples (unpaired) t-test ($p<0.05$).

Postoperative examination on day 1 included IOP, corneal oedema, anterior chamber flare and cell response, the presence of posterior synechiae, capsular changes and visual acuity. Intraocular pressure was measured using an applanation tonometer. Anterior chamber flare and cell response was evaluated according to the criteria of Hogan et al., [20]. Anterior chamber flare, anterior chamber cells, corneal oedema, fibrin in anterior chamber, intraocular pressure, visual acuity, were compared among the control and the test group using independent samples (unpaired) t-test ($p<0.05$).

The standard postoperative drug regime included a combination of Dexamethasone 0.1% and Chloramphenicol eye drops 4 times a day for one week and then given in weekly tapering dose for one month. In cases of elevated IOP (> 22 mmHg) timolol maleate 0.5% eye drops two times a day was added to the standard topical regime.

RESULTS

[Table/Fig-1] shows the preoperative demographic data and ocular observations. The patients in group 1 (with PKE) were significantly older ($p<0.001$) than those in the control group. There was a statistically significant difference in the sex distribution with male predominance in the PEX group (79.4% of patients with PEX were males as compared to 52.9% in the control group ($p=0.039$).

The mean preoperative visual acuity was not significantly different in the two groups ($p= 0.088$). Slit lamp examination showed combined form of cataract (cortical changes with nuclear sclerosis with varying degree of posterior sub capsular cataract) in either group. However, patients with PEX had a predominance of harder cataract (nuclear sclerosis) ≥ grade 3 ($p=0.017$) using LOCS III classification. The mean preoperative IOP in both groups was within normal range and there was no significant difference ($p= 0.105$) but cases with glaucoma in both groups had been excluded. Phacodonesis and zonulodonesis were not seen preoperatively in either group.

[Table/Fig-2] shows the intraoperative observations. Following maximal mydriasis, the mean pupil diameter was significantly smaller in group 1 than in group 2 ($p<0.001$). Mean pupil size in group 1 was 5.40 ± 0.88 mm and in group 2 it was 6.83 ± 0.50 mm ($p<0.001$). Minimum pupil diameter was 3 mm in group1 and 6 mm in group 2. There was no between-group difference in the preoperative axial length. Mean CCC size was 4.87 ± 0.58 mm in group 1 and 5.97 ± 0.27 mm in group 2 ($p< 0.001$). Minimum CCC was 4 mm in group 1 and 5.5 mm in group 2.

Mean phaco time was 49.70 ± 13.75 sec in group 1 and 40.20 ± 10.27 sec ($p = 0.002$) in group 2. This was significantly different; probably due to harder cataract with nuclear sclerosis in PEX group. PC tear (rent) with vitreous loss occurred during emulsification of last fragment in 2.9% (1 case) of eyes in group 1 and none in group 2. Also there was no significant difference between the incidence of zonular dialysis/dehiscence in the PEX group (2.9% -1 case) and control group (none). In the case with PC rent with vitreous loss, one piece PMMA rigid IOL was implanted in the sulcus after performing automated vitrectomy. In the case with zonular dialysis, AC IOL was implanted. In the bag lens fixation was achieved in 94.1 % of eyes in group 1 and 100% of eyes in group 2. Intraoperative PC plaque was noted in 3% of eyes in group 1 while none in Group 2. In 2.9% of patients with PEX, lens was implanted in the sulcus and the same percentage had anterior chamber IOL.

[Table/Fig-3] shows the inflammatory response and IOP 1 day after surgery. Significantly ($p=0.014$) higher postoperative inflammatory response in the form of anterior chamber cells were noted in PEX eyes. No lens decentration/dislocation was seen in the immediate postoperative period in either group. Mean postoperative visual acuity in group 1 was noted to 0.29 ± 0.13 and 0.39 ± 0.14 in group 2 ($p = 0.002$).There was no statistical difference in IOP in the postoperative period in both groups. Mean postoperative IOP was 14.35 ± 4.71 mm Hg in group 1 and 13.82 ± 2.57 mm Hg in group 2 ($p = 0.568$).

DISCUSSION

Several studies have reported differences in surgical outcomes between eyes with and without PEX during cataract surgery. We found PKE to be safe in Indian eyes with PEX syndrome [21]. There was no significant difference in the rate of intraoperative and immediate postoperative complications between the PEX group (2.9%) and the control group (none) in our study.

Even though most cataract surgery in eyes with PEX can be performed under topical anaesthesia, most surgeons prefer peribulbar anaesthesia, especially in cases with small pupil, weak zonules and hard cataracts, to minimize ocular pain caused by stretching of small pupil during phacoemulsification [22]. Also, peribulbar anaesthesia offers the advantage of easy conversion of surgery from phaco to SICS (small incision cataract surgery) if needed.

As reported in other studies [23], the preoperative IOP in both groups in our study was within the normal range. However, Sufi et al., [24] and Shastri and Vasavada [21] report that IOP was significantly higher in patients with PEX. Ravalico et al., [25] found no difference in IOP between the test and control group.

Significantly more eyes in our PEX group had harder cataract with nuclear sclerosis i.e ≥ grade 3. This was consistent with the study by Shastri and Vasavada [21], and Sufi et al., [24]. All eyes in our PEX group had a classic PEX deposition pattern on the anterior lens capsule with or without white pupillary ruff. This indicates a late stage of manifest PEX, as shown by Vogt [26].

We found no signs of phacodonesis or zonulolysis in any eye in either group by preoperative slit lamp biomicroscopy which was in keeping with other studies conducted in India [21,24].

In contrast, the prevalence of zonulolysis and phacodonesis has been extensively reported elsewhere [9,12]. Freyler and Radax [27] reported phacodonesis during capsulorhexis and Shastri and Vasavada [21] and Moreno et al., [9] found a significantly higher incidence of iridophacodonesis in eyes with PEX having light colored irides than in those with dark irides. This indicates the possibility of less severe damage in eyes with dark irides as seen in the Indian population.

A well dilated pupil is one of the main requirements for a safe and successful PKE surgery. This is even more important in eyes with PEX syndrome, in which surgery is more complicated because of the risks associated with loss of zonular integrity and poor pupillary dilatation [28]. In our study, the mean pupil diameter was significantly smaller in eyes with PEX syndrome. Other studies also report a significantly smaller pupil diameter in eyes with pseudoexfoliation [12,21,24]. Pupil stretching maneuvers/devices were used to overcome the problem of insufficient mydriasis in the recent study by Sufi et al., [24]. However, our PKE technique facilitates all maneuvers within a small central space without using any pupil stretching devices and we are able to perform safe PKE through a small pupil without manipulation [29].

The mean CCC size in eyes with PEX was significantly smaller than in control eyes. The smaller CCC was intentional and meant to maintain the capsulorhexis margin safely within the pupillary area and thus under the direct visualization of the surgeon. So we had no difficulty performing an anterior CCC in any eyes in the study. In addition, all maneuvers were within the capsular bag, thus avoiding the risk for excessive stress to the zonules which was also performed by Shastri and Vasavada [21] and Hyams et al.,[15].

Even though 58.8% of eyes in our PEX group had a hard cataract, we encountered frequency of 2.9% of zonular dialysis, posterior capsular tear with vitreous loss in eyes with PEX and 0% in non-PEX group. The phacoparameters (e.g. mean power, mean time) were similar in both groups while the phaco time was higher in the PEX group which was due to harder cataract. Drolsum et al., [12] found a frequency of 9.6% of capsular tear, zonular tear or vitreous loss in eyes with PEX. In the study by Shingleton et al., [14], the rate of vitreous loss was 4% in the PEX eyes and 0% in the non-PEX group. However, recent reports by Shastri and Vasavada [21], Hyams et al., [15] and others report no significant difference in the rate of complications between patients with and without PEX. Freyler and Radax [27] report a significantly lower incidence of complications in eyes with pseudoexfoliation where PKE was performed than in those that had conventional Extracapsular cataract extraction (ECCE). However, they suggest the complications were partly the result of the inexperience of 4 of the 8 surgeons who performed the operations.

Acrylic foldable IOL in the bag is preferred due to minimal zonular stress during implantation provides better capsular support and causes less anterior capsular opacification as compared to PMMA rigid PC IOL. However, we used single piece PMMA rigid, 5.25 mm IOL due to issues related to cost as the surgery was performed on patients screened from free eye care camps. This may be a limitation of our study.

Our results may not be comparable with those in other reports because we did not perform PKE in eyes with severe phacodonesis and subluxated lenses. The major factors contributing to these differences were as follows:

1. Harder cataracts are prevalent in our part of the world. We used stop and chop technique [19], where during chopping, all forces are directed to the center of the nucleus so that it can be used to divide the hardest nucleus with minimal stress to the capsular bag and zonules. Because all maneuvers were performed within a small central area, a small pupil does not hinder the performance of this technique. In addition, first a central space in the nucleus is created and then the entire nucleus is divided into small wedge-shaped segments, which are consumed within the central space in the capsular bag. This allows PKE without the risk of undue stress to the zonules.
2. Surgical experience is a crucial factor that can have substantial effect on the incidence of intraoperative complications. This is supported by other studies by Hyams et al., [15]. Dosso et al., [30] report an intraoperative complication rate of 10% in both control and cohort groups. However, one year later, in another series there were no complications in eyes with PEX. They attribute this to the increasing experience of the surgeon.

On the first post-operative day, there was no significant difference in IOP between the two groups. Two eyes had an IOP of 22 mm Hg or greater. This may be due to incomplete removal of viscoelastic substances during surgery. After treatment with Timolol maleate 0.5% eye drops twice daily for seven days IOP returned to within the normal limits. Others studies report a higher risk of ocular hypertension, inflammation, and posterior synechias postoperatively in eyes with PEX [2]. While significant decrease in IOP after PKE in eyes with PEX compared to the control has been reported in studies by Sufi et al., [24] and Shingleton [17].

The inflammatory flare response was comparable between the 2 groups in our study while significantly higher inflammatory cell response was observed in our PEX group. This may be attributed to pupillary stretch or pupil manipulation that may occur during PKE through a small pupil. However, Shastri and Vasavada [21] found normal inflammatory cell response and significantly higher flare cell response. While a study by Sufi et al., [24] noted higher inflammatory response postoperatively in patients with PEX in the form of flare, cells, corneal oedema and inflammatory membranes. The significantly higher postoperative inflammatory response in patients with PEX can be attributed to the transient break-down of the blood-aqueous barrier that occurs during phacoemulsification in patients with PEX [31]. In addition iris vessels are pathological with an increased permeability for protein in eyes with PEX [32]. However, other studies found the inflammatory reaction after PEX in eyes with pseudo-exfoliation to be within normal limits [19].

BCVA (best corrected visual acuity) [Table/Fig-3] at postoperative day1 was significantly better in the control group compared to the group with PEX ($p = 0.027$). This was attributed to the higher post-operative inflammatory response and corneal oedema which affected the visual acuity in patients with PEX. Further evaluation of improved visual acuity requires follow up which we could not do as majority of these patients were screened for cataract surgery in free eye care camps from different rural areas. The major limitation of our study is lack of long term follow up of the patients. In our study, analysis showed that a longer axial length may be a protective factor against the occurrence of zonular tear during PKE. This was consistent with a previous study by Hyams et al., [15]. In contrast, Kuchle et al., [33] report that axial length was shorter in eyes with PEX and complications than in eyes without complications, but the difference was not significant. Further study is needed to evaluate the association between axial length and intraoperative problems during PKE. A sample size determination was not carried out and only a convenience sample of patients was included in the study.

CONCLUSION

Our study found no significant difference in the incidence of intraoperative and immediate post-operative complication in eyes with uncomplicated PEX as compared to eyes without PEX. However, cataractous eyes with PEX tended to show more anterior chamber cells in the immediate postoperative period. This study emphasizes the fact that PKE can be performed safely by experienced surgeons in eyes with pseudoexfoliation. Follow up studies for a longer duration of time and more number of patients may be required to assess final visual outcome due to the occurrence of the posterior capsule haze /opacity, anterior capsular changes and late intraocular lens (IOL) decentration and dislocation in these eyes.

REFERENCES

[1] Ritch R, Schlötzer-Schrehardt U. Exfoliation syndrome. *Surv Ophthalmol.* 2001;45:265-315.
[2] Naumann GOH, Schlo¨tzer-Schrehardt U, Ku¨chle M. Pseudoexfoliation syndrome for the comprehensive ophthalmologist; intraocular and systemic manifestations. *Ophthalmology.* 1998;105:951- 68.
[3] Seitz B, Müller EE, Langenbucher A, Kus MM, Naumann GO. Endothelial keratopathy in pseudoexfoliation syndrome: quantitative and qualitative morphometry using automated video image analysis. *Klin Monbl Augenheilkd.* 1995;207:167-75.
[4] Gottanka J, Flügel-Koch C, Martus P, Johnson DH, Lütjen-Drecoll E. Correlation of pseudoexfoliative material and optic nerve damage in pseudoexfoliation syndrome. *Invest Ophthalmol Vis Sci.* 1997;38:2435-46.
[5] Asano N, Schlötzer-Schrehardt U, Naumann GO. A histopathologic study of iris changes in pseudoexfoliation syndrome. *Ophthalmology*. 1995;102:1279-90.
[6] Ghosh M, Speakman JS. The ciliary body in senile exfoliation of the lens. *Can J Ophthalmol.* 1973;8:394-403.
[7] Schlötzer-Schrehardt U, Naumann GO. A histopathologic study of zonular instability in pseudoexfoliation syndrome. *Am J Ophthalmol.* 1994;118:730-43.
[8] Küchle M, Vinores SA, Mahlow J, Green WR. Blood-aqueous barrier in pseudoexfoliation syndrome: evaluation by immunohistochemical staining of endogenous albumin. *Graefes Arch Clin Exp Ophthalmol.* 1996; 234:12-18.
[9] Moreno J, Duch S, Lajara J. Pseudoexfoliation syndrome: clinical factors related to capsular rupture in cataract surgery. *Acta Ophthalmol.* 1993;71:181–84.

[10] Alfaiate M, Leite E, Mira J, Cunha-Vaz JG. Prevalence and surgical complications of pseudoexfoliation syndrome in Portuguese patients with senile cataract. *J Cataract Refract Surg.* 1996;22:972–76.
[11] Freissler K, Ku¨chle M, Naumann GOH. Spontaneous dislocation of the lens in pseudoexfoliation syndrome. Arch Ophthalmol. 1995;113:1095–96.
[12] Drolsum L, Haaskjold E, Sandvig K. Phacoemulsification in eyes with pseudoexfoliation. *J Cataract Refract Surg.* 1998;24:787–92.
[13] Kuchle M, Viestenz A, Martus P, Ha¨ndel A, Ju¨nemann A, Naumann GOH. Anterior chamber depth and complications during cataract surgery in eyes with pseudoexfoliation syndrome. *Am J Ophthalmol.* 2000;129:281–85.
[14] Shingleton BJ, Heltzer J, O'Donoghue MW. Outcomes of phacoemulsification in patients with and without pseudoexfoliation syndrome. *J Cataract Refract Surg.* 2003;29:1080–86.
[15] Hyams M, Mathalone N, Herskovitz M, Hod Y, Israeli D, Geyer O. Intraoperative complications of phacoemulsification in eyes with and without pseudoexfoliation. *J Cataract Refract Surg.* 2005;31:1002–05.
[16] Akinci A, Batman C, Zilelioglu O. Phacoemulsification in pseudoexfoliation syndrome. *Ophthalmologica.* 2008;222:112–16.
[17] Shingleton BJ, Nguyen B-KC, Eagan EF, et al. Outcomes of phacoemulsification in fellow eyes of patients with unilateral pseudoexfoliation: single-surgeon series. *J Cataract Refract Surg.* 2008;34:274–79.
[18] Vasavada AR, Desai JP, Singh R. Measuring structures within the eye (letter). *J Cataract Refract Surg*. 1996;22:5– 6.
[19] Vasavada AR, Desai JP. Stop, chop, chop, and stuff. *J Cataract Refract Surg.* 1996;22:526–29.
[20] Hogan MH, Kimura SJ, Thygeson P. Signs and symptoms of uveitis: I. Anterior uveitis. *Am J Ophthalmol*. 1959;47:162-63.
[21] Shastri L, Vasavada A. Phacoemulsification in Indian eyes with pseudoexfoliation syndrome. *J Cataract Refract Surg.* 2001;27:1629–37.
[22] Arup Chakrabarti. Strategies for Pseudoexfoliation and Weak zonules. *Kerala Journal of Ophthalmology.* 2012; XXIV(2).
[23] Honjo M, Tanihara H, Inatani M, et al. Phacoemulsification, intraocular lens implantation, and trabeculotomy to treat pseudoexfoliation syndrome. *J Cataract Refract Surg.* 1998; 24:781–86.
[24] Sufi, et al. Outcome of Phacoemulsification in patients with and without Pseudoexfoliation syndrome in Kashmir. *BMC Ophthalmology*. 2012;12:13.
[25] Ravalico G, Tognetto D, Baccara F. Heparin-surface-modified intraocular lens implantation in eyes with pseudoexfoliation syndrome. *J Cataract Refract Surg.* 1994; 20:543–49.
[26] Vogt A. Ein neues Spaltlampenbild des Pupillengebietes: Hellblauer Pupillensaumfilz mit Ha¨utchenbildung auf der Linsenvorderkapsel. *Klin Monatsbl Augenheilkd.* 1925;75:1–12.
[27] Freyler H, Radax U. Pseudoexfoliationssyndrom-ein Risikofaktor der modernen Kataraktchirurgie? *Klin Monatsbl Augenheilkd.* 1994;205:275–79.
[28] Fine IH, Hoffman RS. Phacoemulsification in the pres-ence of pseudoexfoliation: challenges and options. *J Cataract Refract Surg.* 1997;23:160–65.
[29] Vasavada A, Singh R. Phacoemulsification in eyes with a small pupil. *J Cataract Refract Surg.* 2000;26:1210–18.
[30] Dosso AA, Bonvin ER, Leuenberger PM. Exfoliation syndrome and phacoemulsification. *J Cataract Refract Surg.* 1997;23:122–25.
[31] Kaiya T. Observation of blood-aqueous barrier function after posterior chamber intraocular lens implantation. *J Cataract Refract Surg.* 1990;16:320–24.
[32] Spinelli D, de Felice GP, Vigasio F, Coggi G. The iris vessels in the exfoliation syndrome; ultrastructural changes. *Exp Eye Res.* 1985;41:449–55.
[33] Kuchle M, Schonherr U, Dieckmann U. Risk factors for capsular rupture and vitreous loss in extracapsular cataract extraction. The Erlangen Ophthalmology Group. *Fortschr Ophthalmol.* 1989;86:17–421.

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Clinical Medicine, Associated with Xavier University School of Medicine, Aruba, Kingdom of the Netherlands.
2. Professor, Department of Pharmacology, Associated with Xavier University School of Medicine, Aruba, Kingdom of the Netherlands.
3. Professor, Department of Pharmacology, Associated with Xavier University School of Medicine, Aruba, Kingdom of the Netherlands.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Neelam R Dwivedi,
#23, Santa Helenastraat, Oranjestad, Aruba, Kingdom of the Netherlands.
Phone : 00297-7357766, E-mail : neelammd@xusom.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **May 15, 2014**
Date of Peer Review: **Jul 21, 2014**
Date of Acceptance: **Sep 17, 2014**
Date of Publishing: **Dec 05, 2014**