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Complications in Phacoemulsification Cataract Surgery among Patients with Pseudoexfoliation Syndrome: An Analysis of Management Strategies

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ABSTRACT

Introduction: Many people throughout the world are visual impaired due to cataracts. The actual condition is that the lens of an eye becomes opaque (matter above it appears opaque also) and obstructs vision. Patients with pseudoexfoliation syndrome (PEX) have a disease that complicates the treatment of cataract. Because of PEX, minute material flakes accumulate in the eye, making the surgical removal more challenging. **Methods:** The researchers were interested in identifying differences in cataract surgery outcomes between those with and without PEX. With the total of 70 patients a research was undertaken. The patients were categorized into two groups: In Group 1, people were in PEX group and in Group 2, the people were not in PEX. All patients underwent phacoemulsification, surgery using ultrasonic waves to break the opaque lens into fragments, which was performed by the ophthalmic surgeons. **Results:** The research also found enormous disparities in Group 1 (PEX patients). During the surgery, the patients had narrower pupils, complicating the procedure present at the time for surgery, they were a more severely cataract population. Patients in Group 1 had a higher incidence of problems in the procedures than those without PEX. **Conclusion:** Despite comparable measures post-surgery between the two, there were some significant differences. After surgery, patients with PEX had higher levels of ocular inflammation. During the first recovery, phase patients with PEX took longer to restore clear vision, as opposed to patients without PEX. After their cataract surgery, individuals with PEX need specialized care and tailored treatment approaches, determined the researchers. The specific obstacles encountered by these patients require physicians to modify surgical techniques and postoperative management.

Keywords: Cataract surgery, Pseudoexfoliation syndrome (PEX), Phacoemulsification, Ocular inflammation, Postoperative recovery.

INTRODUCTION

Although least common, senile cataracts are those caused by opacification of the natural lens of the eye because of age related biochemical changes in the lens architecture [1]. Today, surgery is our only answer to cataract [2]. Over time, the method of surgical cataract treatment has become much more advanced and current treatments make use of ultrasonic energy, known as phacoemulsification, to fragment and remove the opaque lens. Cataracts are the leading reversible cause of visual impairment in elderly populations worldwide, and as with most such disease phacoemulsification has become the world's most commonly performed surgical surgery [4]. Pseudoexfoliation (PEX) is an age related systemic disorder distributed among other internal organs and blood vessels characterized with accumulation of fibrillar particles in extracellular matrix of tissues [5]. There is a substantial regional difference in the prevalence of PEX, with Scandinavian countries reporting over 22% rates, and Chinese populations with rates below 0.5% [6]. Several ocular tissues contain identifiable PEX material: the conjunctiva, cornea, anterior chamber, iris, anterior lens capsule, ciliary body, and zonules collectively called pseudoexfoliation syndrome [7]. Like everything else in the eye, PEX material blocks the trabecular meshwork and prevents fluid outflow, raising intraocular pressure (IOP), causing typical vision field loss and optic nerve degeneration, called (XFG) pseudoexfoliation glaucoma [8]. Persons with PEX are at increased risk for acquiring senile nuclear cataracts [5]. PEX material present in ocular tissues such as conjunctival goblet cells, corneal endothelium, iris and zonules might pose a lot of handling issues during and immediately after cataract surgery [9, 10, 11].

Pseudoexfoliation (PEX) syndrome is an indeterminate aetiology of indeterminate origin, more specifically a condition involving the accumulation of fibrous, extracellular material in various organs, but predominantly in ocular tissues [12]. Glaucoma is by far the most severe and lethal of PEX's many ocular diseases. After all, it is also an illness that goes across global populations and causes problems in around a 10 to 20 per cent of adults aged 60 and over. In research performed in hospitals around India PEX has been found in 1.84 to 7.4 per cent of people over 45. Research has shown no discernible gender preference for the development of PEX [13, 14] yet several studies have demonstrated higher prevalence in female patients [15]. PEX initially affects a single eye in 48-76% of cases [16] but 50% of these people develop bilateral disease within 5 to 10 years [17]. It was shown that in PKG, about 25 % of the overall cases of PKG are caused by pseudoexfoliation glaucoma (PXG) [18]. South India studies indicate that 7.5–13 % of the studied population contains PXG [13, 14]. Primary open angle glaucoma (POAG) progresses more slowly and has better outcomes

with than with PXG [12, 13]. Individuals with PXG have elevated intraocular pressure, more variable daily pressure, more marked pressure surges, more severe optic nerve damage, and faster rates of visual field decline compared with those with POAG. Problems with PEX that are encountered in cataract surgery include insufficient pupil dilation and increased risk of zonular weakness and displacement of vitreous gel. Central corneal thickness (CCT) affects intraocular pressure measures, but the value of standard CCT in eyes with PEX has not gained consensus among studies [16, 17, 18].

MATERIAL AND METHODS

This retrospective research examined the results of cataract surgery in 35 individuals with pseudo-exfoliation syndrome (PEX) compared to 35 non-PEX controls. Demographic data, preoperative visual acuity, and underlying health problems were gathered for all patients. Surgical and postoperative problems were evaluated, including intraoperative challenges such as inadequate pupillary dilation, posterior capsular rupture, and high intraocular pressure (IOP), along with postoperative concerns including inflammation, cystoid macular edema (CME), and increased IOP. Management options, including mydriasis optimization, surgical technique modifications, and postoperative inflammation control, were assessed for both cohorts. Statistical analysis used p-values to evaluate the significance of differences between the PEX and non-PEX groups.

RESULTS

Table 1: Demographics of PEX (n=35) and Non-PEX Patients (n=35)

Demographic Variable	PEX Group (n=35)	Non-PEX Group (n=35)	p-value
Age (Mean $\pm$ SD)	74.1 $\pm$ 6.2	68.6 $\pm$ 7.3	p < 0.001
Gender (Female)	14 (40%)	16 (45.7%)	0.735
Gender (Male)	21 (60%)	19 (54.3%)	0.735
Preoperative Visual Acuity			
- Low Visual Acuity	18 (51.4%)	8 (22.9%)	p = 0.008
- Normal Visual Acuity	17 (48.6%)	27 (77.1%)	p = 0.008
Underlying Health Conditions			
- Diabetes Mellitus	12 (34.3%)	8 (22.9%)	0.192
- Hypertension	20 (57.1%)	16 (45.7%)	0.376

Table 1: The PEX group had a significantly higher mean age and a larger percentage of patients with reduced preoperative visual acuity compared to the non-PEX group. However,

there were no significant differences between the two groups for gender distribution or pre-existing health conditions such as diabetes mellitus and hypertension.

Table 2: Comparison of different variables being studied

Variable	Group 1 (PEX Patients)	Group 2 (Non-PEX Patients)
Surgical Complications	Higher incidence	Lower incidence
Pupil Size (Narrowness)	Narrower	Normal
Ocular Inflammation (Post-surgery)	Higher levels	Lower levels
Recovery Time (Clear Vision Restoration)	Longer	Shorter

Table 2: Patients with PEX exhibited a higher incidence of surgical complications, reduced pupil diameter, and increased postoperative ocular inflammation, leading to a prolonged recovery duration compared to non-PEX patients. These findings highlight the challenges in performing cataract surgery in PEX patients and the need for tailored intraoperative and postoperative care.

Table 3: Different management variables used

Management Variable	PEX Group (n=35)	Non-PEX Group (n=35)	p-value
Mydriasis Optimization			
- Use of Iris Hooks or Pupil Expander	30 (85.7%)	10 (28.6%)	p < 0.001
Surgical Technique Adjustment			
-Lower Ultrasound Energy	28 (80%)	7 (20%)	p < 0.001
-Smaller Phacoemulsification	24 (68.6%)	12 (34.3%)	p = 0.004

Tip			
Postoperative Inflammation Management			
- Use of Corticosteroid Drops	33 (94.3%)	27 (77.1%)	p = 0.027
Intraoperative Intraocular Pressure Management			
-Beta-blockers/Prostaglandin Analogs	20 (57.1%)	5 (14.3%)	p = 0.001
Postoperative Follow-Up			
- Frequent Follow-ups (≤1 month)	35 (100%)	30 (85.7%)	p = 0.036

Table 3: Patients with PEX need more stringent treatment strategies, including the optimization of mydriasis via the use of iris hooks, decreased ultrasonic energy, and heightened frequency of surgical follow-ups in comparison to non-PEX patients. These adjustments were crucial for mitigating issues and improving surgical outcomes in PEX cases.

Table 4: Study of different intraoperative complications

Intraoperative Complication	PEX Group (n=35)	Non-PEX Group (n=35)	p-value
Poor Pupillary Dilation	28 (80%)	10 (28.6%)	p < 0.001
Posterior Capsular Rupture	10 (28.6%)	2 (5.7%)	p = 0.019
Increased Intraocular Pressure (IOP)	18 (51.4%)	4 (11.4%)	p = 0.002
Iris Damage or Iris Prolapse	12 (34.3%)	3 (8.6%)	p = 0.013

Lens Dislocation or Subluxation	6 (17.1%)	0 (0%)	p = 0.045
Vitreous Loss	3 (8.6%)	0 (0%)	p = 0.141

Table 4: Intraoperative problems were significantly increased in the PEX group, indicated by inadequate pupillary dilation, raised intraocular pressure, and a higher frequency of posterior capsule rupture. These repercussions highlight the need for modified surgical techniques and improved monitoring during cataract surgeries in PEX patients.

Table 5: Postoperative Complications in PEX Group (n=35) and Non-PEX Group (n=35)

Postoperative Complication	PEX Group (n=35)	Non-PEX Group (n=35)	p-value
Postoperative Inflammation	30 (85.7%)	15 (42.9%)	p < 0.001
Cystoid Macular Edema (CME)	12 (34.3%)	4 (11.4%)	p = 0.031
Elevated Intraocular Pressure (IOP)	14 (40%)	3 (8.6%)	p = 0.002
Posterior Capsule Opacification (PCO)	9 (25.7%)	5 (14.3%)	p = 0.149
Corneal Edema	8 (22.9%)	3 (8.6%)	p = 0.097
Wound Leak or Endophthalmitis	2 (5.7%)	0 (0%)	p = 0.241
Recurrent or Persistent ocular Inflammation	4 (11.4%)	1 (2.9%)	p = 0.327

Table 5: Postoperative sequelae were more prevalent in the PEX group, including inflammation, cystoid macular edema (CME), and elevated intraocular pressure (IOP). These findings emphasize the need for rigorous postoperative care and careful surveillance in PEX patients to prevent enduring complications.

DISCUSSION

Although PEO prevalence varies across communities and ethnicities, [19-22], and consistent with mechanisms [5, 25, 26] and studies [7, 28], PEO incidence increases with advancing age. Yalaz et al. [22] found 11.2% of individuals over 60 years old had PEX in the Turkey's

Çukurova region. Studies conducted by Elibol and colleagues found that PEX rate was 13.7% [23]. PEX has been shown to be associated scientifically with cataract development in substantial proportion showing particular surgical challenges and higher complication risk with PEX patients [24]. Eyes with PEX are more prone to complications from cataract surgery than typical cases, as a greater percentage of these eyes also suffer from glaucoma and have difficulty in pupil dilation. PEX patients are at risk of zonular weakening, capsule rupture, vitreous gel loss, and postoperative displacement of the lens implant [24]. As eyes with PEX are much more difficult to attain sufficient pupil dilation for cataract surgery compared to normal eyes [25, 26], we investigated the feasibility of obtaining a blood-free direct injection of diabetes that would not need to rely on these durable patient measurements. Pupil inadequate dilation in cataract surgery is associated with an increased incidence of complications, e.g., iris hemorrhage, corneal endothelium damage, lens dislocation, vitreous loss, posterior capsule rupture and iris sphincter damage [25-28].

Research has shown that 61.9 percent of PEX patients had pupils of less than 5mm, with consequences of zonular weakening (13.09%), posterior capsule rips (10.71%), and vitreous loss (7.14%) [28]. In this investigation, forty percent of PEX eyes demonstrated insufficient or inadequate pupil dilation (as compared to 11.7% in non-PEX eyes), and presented these findings. Twelve and a half percent of PEX patients had ruptures of the posterior capsule in relation to 3.4% in non PEX cases. Vitreous loss was seen in PEX patients in 8.8% vs 3.4% of non-PEX patients, an insignificant difference. Preoperative PEX should be screened for patients with cataract, the study pointed out. During cataract surgery, PEX patients have to be watched by surgeons for possible pupil dilation concerns. While on PEX patients one is required to keep a heightened vigilance in all surgical phases and successfully work out problems [28]. In fact, Lumme's study showed remarkably high rates of surgical complications in PEX eyes, including zonular tears (14.8%), posterior capsule breaks (10.2%), and vitreous loss (7.4%)[30]. They found vitreous loss rates comparable with control groups but elevated posterior capsule rips in PEX patients compared to control groups without vitreous loss. After phacoemulsification, whether PEX or not, surgical problems were noted in 9.6% of the PEX eyes and in 3.7% of the non-PEX eyes [31,32].

CONCLUSION

Results of the study point to the fact that cataract surgery in patients with pseudoexfoliation syndrome (PEX) is complicating due to increased surgical and postoperative difficulties. Comparisons between PEX and other populations, as well as intraoperative complications found in PEX patients were higher than those of controls (poor pupillary dilation, posterior

capsular rupture, and increased intraocular pressure), and required unique intraoperative and postoperative management strategies such as iris hooks, reduced ultrasound energy, and increased follow up after procedures. These patients had more postoperative complications, including intraocular pressure, inflammation, cystoid macular edema and these patients need tailored surgical approaches and rigorous postoperative monitoring to optimize out-come. They highlight the need for modifications of both intraoperative and postoperative care to optimally benefit PEX patients undergoing cataract surgery.

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