

A Study of Eyes with Pseudoexfoliation, its Association with Cataract and its Implications in Cataract Surgery

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ABSTRACT

Introduction: Pseudoexfoliation syndrome is a systemic condition with eye manifestations. Ocular manifestations of PXS include iris depigmentation, phacodonesis or lens subluxation caused by zonular dehiscence. Loss of lens zonular support makes intraocular surgeries challenging with the potential for vitreous loss, lens subluxation or even lens dislocation. Current study was done to study the eyes with pseudoexfoliation, its association with cataract and its implications in cataract surgery.

Material and Methods: A hospital based prospective study was conducted in 290 eyes (with PXF) of 170 patients attending ophthalmology OPD over a period of 3 years. Cataract surgery was performed for 156 eyes.

Results: In the study, 54% (156 eyes) had cataract in association with PXF, out of which 62% (97eyes) were nuclear cataract. Complications associated with cataract surgery included vitreous loss, posterior capsular rent, zonular dialysis.

Conclusion: PXS presents challenges that need careful pre-operative planning and intraoperative care to ensure safe surgery and a successful post-operative outcome.

Keywords: Pseudoexfoliation, Phacodonesis, Nuclear Cataract, Cataract Surgery

INTRODUCTION

Pseudoexfoliation syndrome is a systemic condition with eye manifestations. In the eye, pseudoexfoliative material deposits on various structures of the anterior segment. The nature of this material is mostly fibrillar with fibers made up of microfibrils and coated with amorphous material. The composition of these fibrils is diverse and includes basement membrane components as well as enzymes involved in extracellular matrix maintenance. Pseudoexfoliation is the most common cause of secondary open angle glaucoma (pseudoexfoliative glaucoma) worldwide.

PXS familial aggregation suggests genetic inheritance. PXS has been strongly associated with single nucleotide polymorphisms (SNPs) of lysyl oxidase-like 1 (LOXL1) gene on chromosome 15q24.1.¹

The most important and easily recognizable diagnostic sign of pseudoexfoliation is whitish- grey flaky material on the pupillary border of the iris or on anterior surface of lens. The lens frequently demonstrates a 'three-ring sign' on the anterior lens capsule which consists of a relatively homogenous central zone and a granular cloudy peripheral zone with a clear zone in between, as seen in fig-1. Pseudoexfoliative material is also often observed by slit lamp examination at

pupillary margin, on the lens zonules and on the trabecular meshwork.

Ocular manifestations of PXS include iris depigmentation leading to peripupillary transillumination defects, mild trabecular meshwork hyperpigmentation, secondary open angle glaucoma, phacodonesis or lens subluxation caused by zonular dehiscence. Loss of lens zonular support makes intraocular surgeries challenging with the potential for vitreous loss, lens subluxation, or even lens dislocation.

Current study was done to study the eyes with pseudoexfoliation, its association with cataract and its implications in cataract surgery

MATERIAL AND METHODS

A hospital based prospective study was conducted in 290 eyes of 170 patients attending ophthalmology OPD, Mamata medical college and hospital, Khammam during January 2015 to January 2018. Patients were included in the study after careful slit-lamp examination. Patients with traumatic cataract or with occupational history of exposure to intense infrared lights i.e. glass blowing that may cause true exfoliation were excluded from the study.

Ophthalmological workup was done in all patients. Patients requiring cataract surgery underwent routine investigations. After physician fitness for the procedure, manual small incision cataract surgery was done in 133 eyes and phacoemulsification was done in 12 eyes after informed consent. Combined SICS with trabeculectomy was done in 11 eyes, in patients with both cataract and advanced glaucoma. Additional modifications during the surgery were made whenever necessary. Topical steroid- antibiotic eye drops were prescribed in tapering doses for the operated eye. Pseudoexfoliative glaucoma was diagnosed based on optic disc evaluation, intraocular pressure and visual field defects. Patients with other causes of glaucoma and not due to PXF

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How to cite this article: Prachee H. Nagrale, Vijaykumar Kesharaju, Nanda Nandan, Kavya Reddy. A Study of Eyes with Pseudoexfoliation, its Association with Cataract and its Implications in Cataract Surgery. International Journal of Contemporary Medical Research 2018;5(9):11-15.

DOI: <http://dx.doi.org/10.21276/ijcmr.2018.5.9.29>

were excluded. Various grades of glaucoma were treated by either medical line of management or surgery or both depending on their response to treatment. Other ocular manifestations seen in PXF patients were also noted in due

Age Group	Frequency
45-54	5
55-64	36
65-74	82
75-84	41
85-95	6
Total	170

Table-1: Age Distribution

Gender	Number of patients	Percentage
Males	70	41.17
Females	100	58.82
Total	170	100

Table-2: Sex Distribution

Laterality	Number of patients	Percentage
Unilateral	50	30
Bilateral	120	70
Total	170	100

Table-3: Laterality

Iris	Number of Eyes
Altered	36
Moth-eaten appearance	43
Posterior Synechia	4
Iridodonesis	18
Atrophy	34
Normal Iris	155
Total	290

Table-4: Iris Features

Pupil Size	Number of Eyes	Percentage
Adequate (>5mm)	168	58
Inadequate (<5mm)	122	42
Total	290	100

Table-5: Pupil Dilatation

Cataract	Number of eyes	Percentage
Yes	156	54
No	134	46
Total	290	100

Table-6: Incidence of Cataract in PXF eyes

Morphology	Number of Eyes	Percentage
Nuclear Cataract	97	62.17
Mixed Cataract	50	32.05
Posterior Subcapsular Cataract	7	4.48
Complicated Cataract	1	0.64
Cortical Cataract	1	0.64
Total	156	100

Table-7: Morphology of Cataract in PXF eyes

Vision	Number of eyes	Percentage
≤ CF 3mts	134	85.89
CF 3mts – 6/36	20	12.82
6/12 – 6/24	2	1.28
≥ 6/12	0	0
Total	156	100

Table-8: Pre-operative Visual Acuity of Cataract patients

Lens Characteristics	Number of Eyes	Percentage
PXF -anterior capsule	72	46.15
Phacodonesis	19	12.17
Subluxation	3	1.92
Dislocation	1	0.64
Normal	61	39.10
Total	156	100

Table-9: Lens Characteristics in patients posted for surgery

Surgery	Number of patients	Percentage
SICS + PCIOL	129	82.69
Phaco + PCIOL	12	7.69
SICS + PCIOL + Trab	11	7.05
SICS + ACIOL	4	2.56
Total	156	100

Table-10: Kinds of Surgical Procedure Performed

Modification	Number of eyes
Sphincterotomy	16
Synechiolysis	2
Anterior Vitrectomy	4
Capsular Tension Ring	5

Table-11: Additional Procedures in surgery

Complication	Number of eyes
Posterior Capsular Rent	5
Zonular Dialysis	2
Vitreous Loss	4

Table-12: Intraoperative Complications

Visual Acuity	Number of eyes	Percentage
≥ 6/12	126	80.76
6/18 – 6/36	24	15.38
≤ 6/60	6	3.84
Total	156	100

Table-13: Post-operative Visual Acuity at 6 weeks

Angle Grading	Number of eyes	Percentage
Closed angle	0	0
Grade 1	0	0
Grade 2	2	0.68
Grade 3	28	9.65
Grade 4	260	89.65
Total	290	100

Table-14: Gonioscopic Status in patients with PXF

PXF material	Number of eyes	Percentage
Present	116	40
Absent	174	60
Total	290	100

Table-15: PXF material in angle structures

Tissue Involvement	Clinical Signs	Clinical Complications	Surgical Complications
Cornea	- atypical corneal guttata	- endothelial decompensation - endothelial proliferation	- endothelial decompensation
Trabecular Meshwork	- Pigment deposition - marked asymmetry of IOP - marked IOP rise after pupillary dilation	- intraocular hypertension - open angle glaucoma	- postoperative IOP rise
Iris	- peripupillary atrophy and iris sphincter region transillumination - melanin dispersion associated with pupillary dilation - poor mydriasis, asymmetric pupil sizes	- melanin dispersion - poor mydriasis - iris rigidity - blood-aqueous barrier impairment - pseudouveitis - anterior chamber hypoxia - posterior synechiae	- miosis/ poor surgical access - intra and post operative hyphaema - postoperative inflammation - prolonged blood-aqueous barrier breakdown - posterior synechiae and pupillary block
Lens, Ciliary body and zonules	- diffuse precapsular layer - phacodonesis - PEX deposits on zonules	- cataract - phacodonesis - lens subluxation - angle closure glaucoma due to pupillary and ciliary block	- zonular rupture/ dialysis - vitreous loss - posterior capsule rupture - decentration of lens implant - anterior capsule fibrosis - secondary cataract

Table-16: Clinical signs and complications of pseudoexfoliation (PEX) syndrome

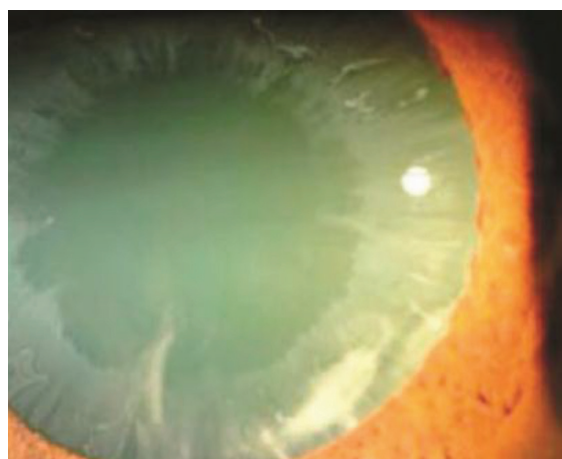


Figure-1: Photograph showing classic pattern of PXF on lens

course of study.

RESULTS

The average age of patients in the study was 65 ± 9 years. Frequency distribution of various age groups is shown in table 1. There were 70 (41.17%) males and 100 (58.82%) females. 120 patients had bilateral PXF and 50 had unilateral PXF, accounting to a total of 290 PXF eyes considered in this study. There was insufficient mydriasis in 122 eyes (42%), as shown in table 2-5. Iris features were considered based on morphological appearance in slit lamp examination, tabulated in table 4. When normal structure was absent with loss of corallite and furrows, it was considered iris-altered. Patients with prior history of cataract surgery or intraocular procedure affecting iris characteristics were excluded in the consideration.

Pupil Dilatation: A special mention was made to assess the pupillary dilatation after instillation of tropicamide 0.5% eye drops. Post-dilatation size of pupil less than 5mm after 30 to 40 min was considered inadequate. Number of eyes having inadequate pupillary dilatation is shown in table 5. In the present study, 54% (156 eyes) had cataract in association with PXF, out of which 62% (97 eyes) were nuclear cataract, as shown in table 6 and 7. Pre-operative visual acuity in patients with cataract is shown in table 8. Lens characteristics in patients with cataract is represented in table 9. Surgeries were performed in 156 patients. Various kinds of surgical procedures performed is represented in table 10. Surgeries were performed in 156 patients. Various kinds of surgical procedures performed is represented in table 10. Apart from regular surgical steps, a few additional procedures were performed during surgery which might be attributed to presence of PXF and its associated ocular manifestations. Additional procedures performed are shown in table 11. Apart from regular surgical steps, a few additional procedures were performed during surgery which might be attributed to presence of PXF and its associated ocular manifestations. Additional procedures performed are shown in table 11. Complications associated with cataract surgery were seen in 11 eyes. Complications included vitreous loss in 4 eyes, posterior capsular rent in 5 eyes, zonular dialysis in

2 eyes. Intraoperative complications are mentioned in table 12. Post-operative visual acuity is mentioned in table 13. Gonioscopic status in patients with PXF is shown in table 14 and number of eyes having presence of PXF material in angle structures is mentioned in table 15.

DISCUSSION

Local production and deposition of pseudoexfoliative fibers may lead to characteristic changes of the corneal endothelium, trabecular meshwork, iris, lens, ciliary body, zonules and structures of blood- aqueous barrier.^{2,3,4} These alterations of tissues of the anterior eye segment make cataract surgery potentially challenging and thus surgeons must be aware of numerous intraoperative and postoperative problems in managing the patients with pseudoexfoliation syndrome. Two pathological manifestations of pseudoexfoliation, zonular weakness and poor pupillary dilation have been identified as the most significant risk factors for surgical complications.

Zonular weakness can be attributed to the deposition of pseudoexfoliative material on zonular fibers and ciliary processes resulting in proteolytic disintegration of the zonules that can lead to spontaneous devastation. Thus, a significant zonular instability can cause phacodonesis, spontaneous subluxation of lens and angle closure glaucoma due to pupillary and ciliary block.^{5,6}

In the present study, 54% (156 eyes) had cataract in association with PXF. Nuclear cataract and subcapsular cataract are more frequently found in eyes with PXF than in eyes without PXF.⁷ In the present study, nuclear cataract was seen in 97 out of 156 (62.17%) eyes. The result of our study is comparable with Blue Mountain eye study where nuclear cataract was seen in 61.1% of eyes.⁸

A cohort study by Scorolli et al had intra-operative complications of capsular or zonular breaks in 2.6% and vitreous loss in 11% with significant difference with matched controls of non-PXF eyes.⁹ Similar observations were seen by Naseem A et al with capsular or zonular breaks in 15.6% and vitreous loss in 9.4% eyes respectively.¹⁰ Naumann GO et al in their study of 72 eyes with PXF found a sevenfold increase in vitreous loss in eyes with PXF. They also noted the incidence of post capsular rent to be 4.2% in eyes with PXF and 2.8% in eyes without PXF.¹¹ In the present study, complications associated with cataract surgery were seen in 11 eyes out of 156 eyes. Complications included vitreous loss in 4 eyes, posterior capsular rent in 5 eyes, zonular dialysis in 2 eyes.

Complications during Phaco surgery are mostly related to zonular weakness and therefore require particular attention. Depending on zonular weakness or dialysis, a capsular tension ring (CTR) could be inserted prior to Phaco or after nucleus Phaco and prior to cortical irrigation- aspiration. In difficult cases Cionni modified – CTR (mCTR) or capsular tension segments (CTS) could be inserted either alone or in combination. For more advanced zonular instability, the mCTR or CTS both of which can be sutured to the sclera for improved fixation should be considered.

Post-operative decentrations of IOLs were reported to be significantly higher in eyes with PEX due to zonular rupture or capsular bag decentration.

It should be kept in mind that the pseudoexfoliative process will continue even after the surgery, thus the patient should be monitored for possible development of glaucoma, capsular phimosis syndrome or decentration of IOL. There is also a possible risk of future IOL-CTR capsule complex dislocation which may require surgical intervention.

Capsulorhexis size is important and should be performed within the limits of outer pseudoexfoliation ring. Too small a diameter will add further stress to loose zonules during the operation whereas too large a diameter may engage the zonular attachments. Due to the tendency of anterior capsular phimosis and further zonular stress a large capsulorhexis should be performed with recommendation of at least 5.5mm in diameter.

Hydrodissection/ hydrodelineation should be performed very carefully with minimal stress on the zonule. However, the degree of dissection must be balanced since too aggressive an injection of fluid can lead to further loosening. During hydrodissection it is essential that the anterior chamber not be overfilled as this would cause excessive zonular stress. To avoid this situation gentle burping of the incision during hydrodissection can allow release of fluid and keep the anterior chamber at normal pressure.

In glaucomatous patients, combined cataract and glaucoma surgery decreases the incidence of an acute postoperative rise in IOP and may improve long term control of IOP.

A prospective randomized clinical trial comparing travoprost, latanoprost and dorzolamide- timolol fixed combination in individuals with PXF showed IOP lowering ranged from 8 to 11 mmHg.¹² Use of prostaglandin analog is preferred for initial medical management because of its high efficacy for lowering IOP and longer duration of action, which may be helpful in blunting PXF glaucoma- associated pressure spikes.

Use of pilocarpine as initial line medical therapy is not recommended as pilocarpine can cause posterior synechiae with associated angle closure glaucoma and exacerbate formation of cataract. Pilocarpine also can induce anterior rotation of the lens and exacerbate pre-existing anterior subluxation secondary to zonulopathy with risk of pupillary block.

Posterior capsular opacification is increased in PEX eyes most probably due to an aggravated blood – aqueous barrier breakdown. Various clinical signs and complications associated with pseudoexfoliation syndrome are tabulated in table 16.

A complete evaluation can aid in proper informed consent of the increased risks associated with cataract surgery and pre-operative and intra-operative planning (with anticipatory equipment such as iris hooks and capsular tension rings (CTRs) at the ready and possibly having a vitreoretinal surgeon available for vitrectomy and pars plana lensectomy. Proper follow-up of patients after surgery is needed to evaluate endothelial cell function, IOP rise, inflammation

and IOL dislocation.

Aggregates of exfoliation fibers have been identified in skin and in autopsy specimens of heart, lung, liver, kidney, gall bladder and cerebral meninges in two patients with ocular PXF.¹³ The deposits were focally present in the interstitial fibrovascular connective tissue septa of these organs, frequently adjacent to elastic fibers, elastic microfibrils, collagen fibers, fibroblasts and to the walls of small blood vessels.

In the Blue Mountain Eye Study (Australia), PXF correlated positively with a history of hypertension, angina, myocardial infarction or stroke, suggestive of vascular effects of the disease.¹⁴ In another study, 50% of persons with PXF had cardiovascular disease, three times the rate of unaffected subjects.

CONCLUSION

Pseudoexfoliation syndrome presents challenges that need careful pre-operative planning and intraoperative care to ensure safe surgery and a successful post-operative outcome. Proper follow-up of patients after surgery is needed to evaluate endothelial cell function, intraocular pressure rise, inflammation and intraocular lens dislocation. Conclusively, the risks associated with cataract surgery in pseudoexfoliation eyes can be minimized with appropriate pre-operative, intraoperative and post-operative care.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 23-08-2018; **Accepted:** 17-09-2018; **Published:** 28-09-2018