Original Research Article

A study of evaluation of anterior segment changes in eyes with pseudo exfoliation syndrome including anterior chamber depth status of lens anterior chamber angle preoperatively

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Abstract

Background: Pseudoexfoliation syndrome is an important ocular manifestation of a systemic disease, found to be common in cataract patients as well as in 50% of glaucoma patients. Present study was intended to assess the profile of Pseudoexfoliation syndrome and evaluate the surgical outcome of Manual Small Incision Cataract Surgery in Pseudoexfoliative eyes. **Material and Methods:** Present study was prospective, observational, hospital-based study, conducted in patients with age more than 50 years, with Pseudoexfoliation, admitted for cataract surgery, posted for Manual Small incision cataract surgery(MSICS). All patients underwent a manual small incision cataract surgery, and visual outcomes of the procedures were recorded on the first postoperative day. **Results:** In present study, maximum numbers of patients were from the age group of 70-79 years (62.5%) and 56 (70%) patients were males and 24 (30%) were females. In this study of 80 patients with Pseudoexfoliation Syndrome, 60 patients had Bilateral Pseudoexfoliation i.e. 120 eyes (85.71%) while 20 patients had Unilateral Pseudoexfoliation i.e. 20 eyes (14.29%). In majority of the eyes 111 (79.29%) had involvement of lens with Pseudoexfoliation while 109 (77.86%) had pupillary involvement. Mean Anterior Chamber Depth in Pseudoexfoliative eyes was 2.50±0.22 mm. Majority of the eyes i.e. 74 (52.9%) were having IOP between 16 – 20 mm Hg. 61 eyes (43.6%) had IOP between 11 – 15 mm Hg. 80 eyes of 80 patients underwent MSICS, 17 (21.25%) patients developed Intraoperative Complications. **Conclusion:** There is significant association between Pseudoexfoliation syndrome and age, male preponderance and bilateral involvement of eyes. MSICS provides significant improvement in visual outcome in patients with Pseudoexfoliation syndrome with cataract.

Keywords: Pseudoexfoliation syndrome, lens, anterior eye structures, MSICS, visual outcome

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INTRODUCTION

Pseudoexfoliation syndrome is an important ocular manifestation of a systemic disease, found to be common in cataract patients as well as in 50% of glaucoma patients.[1] Clinically the diagnosis is made by detecting the whitish powdery deposits along the pupillary margin or whitish grey flaky material on the anterior surface of the lens or both. One of the significant concerns for patients with Pseudoexfoliation syndrome is increased incidence of intra and post-operative complications such as zonular dialysis, capsular rupture and vitreous loss when they undergo cataract surgery.[2] During cataract surgery these patients

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have more chances of developing sphincter tear, difficult nucleus delivery due to rigid pupil and posterior synechiae and zonular dialysis with or without vitreous loss due to weak zonules.[3] Glaucoma is the most important sequela of PXF syndrome.[4] The important step in reducing the surgical complication in Pseudoexfoliative eyes. is by achieving good mechanical or pharmacological dilatation, possibly reduce the stress on the capsular bag by creating a wider capsulorhexis.[4] Post operatively there can be increased incidence of prolonged corneal oedema, severe anterior chamber reaction, and raised intra ocular pressure. Late dislocation of the intraocular lens within the bag or dislocation of the entire bag has also been reported.[5] The increasing prevalence of Pseudoexfoliation syndrome and cataract with age and its association has a major public health implication in India. Present study was intended to assess the profile of Pseudoexfoliation syndrome and evaluate the surgical outcome of Manual Small Incision Cataract Surgery in Pseudoexfoliative eyes.

MATERIAL AND METHODS

Present study was prospective, observational, hospital-based study, conducted Department of Ophthalmology at a Tertiary Care Hospital from August 2016 to September 2018 (2 years). This study was conducted after approval by Institutional Ethics Committee.

Inclusion criteria: Patients with age more than 50 years, with Pseudoexfoliation, admitted for cataract surgery, posted for Manual Small incision cataract surgery(MSICS). Patients willing to participate in the study.

Exclusion criteria: Patients with raised intra ocular pressure(IOP). Patients with glaucomatous disc change. Patients with other causes of cataract like traumatic, metabolic, complicated, etc. Patients with uncontrolled diabetes mellitus or other severe systemic and cardiovascular diseases. Patients not giving consent to Manual Small Incision Cataract Surgery. Patients having iridodonesis, phacodonesis and subluxation of the lens due to any other pathology or any other allied ocular pathology preoperatively.

Patients recruited were informed about the nature and objective of the study and written consent was obtained. Demographic data, complaints related to diminution of vision, detailed history was collected and detailed general, systemic and ocular examination was conducted. All recruited patients underwent detailed ocular examination pre and post cataract surgery (Manual Small Incision Cataract Surgery). Visual acuity of all patients was recorded with the help of Snellen's chart or Illiterate E chart wherever required. Best corrected visual acuity along with near vision was noted in all patients. Torch light examination was performed to rule out any ocular abnormality. The lids were examined for edema, discharge. Regurgitation test was performed to check for infection of the lacrimal sac. The conjunctiva and sclera were examined. Anterior chamber depth was assessed on torch light examination as normal, shallow or deep and was noted. Examination of pupil for size, shape and reaction was done. All patients were preoperatively evaluated on slit lamp (Zeiss model) and both eyes were examined for the presence of Pseudoexfoliation. The cornea was examined by slit lamp by all methods of examination. Diffuse illumination for general survey and site of corneal lesions, focal illumination for presence of flakes of Pseudoexfoliation material. Anterior chamber was assessed for depth and presence of any cells flare, hypopyon, hyphaema, vitreous and IOL. Iris was examined for the presence of any Pseudoexfoliative material in the form of white flecks on the pupillary margins of iris, loss of pigment at the pupillary ruff, diffuse mid-peripheral transillumination defects. The surface of lens was looked for any radial line and/or granular deposits. Pseudoexfoliation was diagnosed by the presence of typical layered white deposits on the anterior lens surface. The anterior chamber depth was measured by contact probe of A scan machine and peripheral anterior chamber depth was graded according to the Van Herick System. Intraocular Pressure was measured in all patients using Goldmann's Applanation Tonometer by a single observer. The assessment of configuration of angle of anterior chamber was done using Zeiss four mirror gonioscope. Accumulation of Pseudoexfoliative material, excessive pigmentation of trabecular meshwork or Sampaolesi's line was looked for and noted. The pupil diameter of each patient was measured before dilatation. Maximum pupil size was recorded after instilling a mydriatic. Tropicamide and Phenylephrine combination along with NSAID eye drop were used for dilatation. Keratometry was done using Auto kerator-efractometer (Potec PRK – 5000 Autoref-keratometer). Biometry was done using ultrasonic measurement of axial length by USG-A Scan (BIOMEDIX ECHORULE-2) using a contact A scan probe with the patient in a sitting position. All patients underwent a manual small incision cataract surgery, performed by same surgeon under local anaesthesia. Visual outcomes of the procedures were recorded on the first postoperative day in our study. All patient data was recorded on pretested computed coded proforma. The data was recorded in preformed pretested proformas, and compiled using Microsoft Excel. Statistical analysis was done by using descriptive and inferential statistics using Chi Square test and software used in the analysis were SPSS 22.0 version and GraphPad Prism 7.0 version and $p<0.05$ is considered as level of significance.

RESULTS

In present study, maximum numbers of patients were from the age group of 70-79 years (62.5%), followed by age group of 60-69 years (31.25%). Mean age of patients was 71.83 ± 5.80 years. In this study, 56 (70%) patients were males and 24 (30%) were females.

Table 1: Age and gender wise distribution of patients

Age Group (years)	Male	Female	Total
51-59 years	0(0%)	1(1.25%)	1(1.25%)
60-69 years	19(23.75%)	6(7.5%)	25(31.25%)
70-79 years	34(42.5%)	16(20%)	50(62.5%)
≥80 years	3(3.75%)	1(1.25%)	4(5%)
Total	56(70%)	24(30%)	80(100%)
Mean ± SD	71.53±5.60	72.54±6.32	71.83±5.80

In this study of 80 patients with Pseudoexfoliation Syndrome, 60 patients had Bilateral Pseudoexfoliation i.e. 120 eyes (85.71%) while 20 patients had Unilateral Pseudoexfoliation i.e. 20 eyes (14.29%).

Table 2: Distribution of number of eyes with pseudoexfoliation

Laterality	No of patients	No of eyes	Percentage (%)
Unilateral Pseudoexfoliation	20	20	14.29
Bilateral Pseudoexfoliation	60	120	85.71
Total	**80**	**140**	**140**

In majority of the eyes 111 (79.29%) had involvement of lens with Pseudoexfoliation while 109 (77.86%) had pupillary involvement. Pseudoexfoliation involving Iris was seen in 56 (40%) of eyes, while Pseudoexfoliation involved 20 (14.29%) of cornea and 6 (4.29%) of angle.

Table 3: Anterior segment changes

Anterior segment changes	Right eye changes	Left eye changes	Total
Cornea	3(50%)	3(50%)	6
Angle	10(50%)	10(50%)	20
Iris	31(55.36%)	25(44.64%)	56
Pupil	57(52.29%)	52(47.71%)	109
Lens	52(46.85%)	59(53.15%)	111

Mean Anterior Chamber Depth in Pseudoexfoliative eyes was 2.50±0.22 mm. majority of the eyes, 81 (57.86 %) with Pseudoexfoliation were of 2 – 2.5 mm dept with mean depth of 2.34±0.11 mm whereas 59 eyes (42.14%) were of 2.6 – 3mm depth with mean depth of 2.72±0.12 mm.

Table 4: Anterior chamber depth

Anterior chamber depth	No of eyes	Percentage (%)	Mean±SD
< 2 mm	0	0	
2-2.5 mm	81	57.86	2.34±0.11
2.6-3 mm	59	42.14	2.72±0.12
>3 mm	0	0	
Total	**140**	**100**	**2.50±0.22**

Majority of the eyes i.e. 74 (52.9%) were having IOP between 16 – 20 mm Hg. 61 eyes (43.6%) had IOP between 11 – 15 mm Hg while only 2 eyes (1.4%) had IOP more than 20 mm Hg and 3 eyes (2.1%) had IOP less than equal to 10mmHg. Mean IOP recorded in 140 eyes with Pseudoexfoliation was 15.60±2.21 mm Hg.

Table 5: Intra ocular pressure (IOP) in eyes with pseudoexfoliation

IOP Distribution	No of eyes with Pseudoexfoliation	Percentage (%)
≤ 10 mm Hg	3	2.1
11-15 mmHg	61	43.6
16-20 mmHg	74	52.9
>20 mmHg	2	1.4
Mean±SD	15.60±2.21(9-21 mmHg)	

80 eyes of 80 patients underwent MSICS, 17 (21.25%) patients developed Intraoperative Complications. In present study

Zonular Dialysis was found in 3 eyes (17.65%) and Zonular Dialysis with Vitreous Loss was seen in 4 eyes (23.53%). Posterior Capsular Rent was found in 2 eyes (11.76%) and PCR with Vitreous Loss was found in 4 eyes (23.53%). Sphincter Tear was noted in 3 eyes (17.65%) and Iridodialysis was seen in one eye (5.88%).Total 8 eyes had Vitreous Loss. Intraoperative use of Capsular Tension Ring and Iris Hooks was done in 4 eyes with small pupils. No Intraoperative Complications were noted in 63 eyes (78.72%).

Table 6: intraoperative complications (n=17)

Intraoperative Complications	No of eyes	Percentage (%)
Zonular Dialysis	3	17.65
Posterior Capsular Rent	2	11.76
Sphincter Tear	3	17.65
Iridodialysis	1	5.88
Posterior Capsular Rent +Vitreous loss	4	23.53
Zonular Dialysis + Vitreous Loss	4	23.53

70 (87.5%) eyes achieved visual acuity of near normal vision postoperative whereas 7 (8.75%) eyes achieved vision of 6/18-6/60 (Visually impaired). 3(3.75%) patients had vision of <6/60-FC 3m (Severe visual impairment). It was observed that there was significant difference ($p < 0.05$) in visual acuity post operatively following MSICS.

Table 7: Postoperative visual outcome

Visual Acuity	BCVA Preoperative	UCVA Postoperative
Near Normal(≥6/18)	10(12.5%)	70(87.5%)
Visually impaired(<6/18-6/60)	38(47.5%)	7(8.75%)
Severe visual impairment(<6/60-FC 3m)	9(11.25%)	3(3.75%)
Social Blind(FC 3m - ≥ FC 1m)	12(15%)	0(0%)
Legal Blind(FC 1m to PL)	11(13.75%)	0(0%)
Blind(NPL)	0(0%)	0(0%)

Chi Square value=92.36, p-value=0.0001, Significant

In our study we found that complications occurred frequently in Anterior Chamber Depth of 2 - 2.5 mm. All 17 patients with complications had ACD in the range of 2 – 2.5 mm with mean ACD of 2.33 ± 0.12 mm.

Table 8: Distribution of anterior chamber depth and complications

Anterior chamber depth	No of eyes	No of operated eyes	Mean±SD	Complications
< 2 mm	0(0%)	0(0%)	0±0	0(0%)
2-2.5 mm	81(57.86%)	53(66.25%)	2.33±0.12	17(100%)
2.6-3 mm	59(42.14%)	27(33.75%)	2.68±0.09	0(0%)
>3 mm	0(0%)	0(0%)	0±0	0(0%)
Total	**140(100%)**	**80(100%)**	**2.45±0.20**	**17(100%)**

In our study we found that complications occurred frequently in Dilated pupil size of 5.1-6 mm {11(64.71%)} and this was statistically significant ($p < 0.05$).

Table 9: Distribution of dilated pupil size and complications

Dilated pupil size (mm)	No of eyes	No of operated eyes	Mean±SD	Complications
3.1-4 mm	2(1.43%)	2(2.5%)	3.80±0	1(5.88%)
4.1-5 mm	6(4.29%)	6(7.5%)	4.91±0.26	5(29.41%)
5.1-6 mm	33(23.57%)	28(35%)	5.71±0.25	11(64.71%)
6.1-7 mm	99(70.71%)	44(55%)	6.65±0.23	
Total	**140(100%)**	**80(100%)**	**6.06±0.80**	**17(100%)**

Chi square value=79.59, p=0.0001, Significant

In 80 patients undergoing SICS, 17 patients had complications. Complications rate were maximum in patients having only Nuclear Sclerosis i.e. 6 patients out of 17 (35.29%), followed by 4 patients (17.65%) with Hypermature Cataract, 4 patients (23.53%) with combined Nuclear and Cortical Cataract and 3 patients (23.53%) with Mature Cataract had complications.

Table 10: Distribution of lens morphology and complications

Lens Morphology	No of eyes n	No of operated eyes	Complications
NS	69(49.29%)	42(52.5%)	6(35.29%)
Cortical	13(9.29%)	7(8.75%)	0(0%)
NS+C	33(23.57%)	17(21.25%)	4(23.53%)
NS+PSC	6(4.29%)	3(3.75%)	0(0%)
MAT	8(5.71%)	8(10%)	4(23.53%)
HMSC	3(2.14%)	3(3.75%)	3(17.65%)
Pseudophakia	8(5.71%)	0(0%)	0(0%)
Total	140(100%)	80(100%)	17(100%)

Chi square value=7.98, p=0.046, Significant

DISCUSSION

In present study, maximum number of patients were in the age group of 70-79 years (62.50%). In a study done by C N Gupta *et al.*,[6] majority of patients were of age group 61-70 (47.5%) and from 71-80 years age group (37.5%). The prevalence of Pseudoexfoliation syndrome was increased and found to be statistically significant ($p<0.01$) with age of the patients. In study by M Nazarul Islam *et al.*,[7] out of 512 patients of cataract with Pseudoexfoliation undergoing MSICS, maximum of number of patients in age group of 71 – 80 years (41.11%), which is corresponding with our results. In study done by Anmol *et al.*,[8] and Bojan Kovac *et al.*,[9] mean age of patients was found to be 67.95 years and 79.70 years respectively. These results are consistent with our study (mean age 71.83years) Thus, it can be seen that there is increase prevalence of PXF with increase in age all over the globe. In our study of 80 patients, 56 (70%) patients were males and 24 (30%) were females with Male to Female ratio of 2.3:1. Similar results were found in studies done by Bairy SN *et al.*,[10] among 90 cases of Pseudoexfoliation, males were 63 (70%) and females, 27 (30%). Our study is similar to study done by B Ramalakshmi *et al.*,[11] has found 23 patients (37.09%) to have unilateral involvement while 39 patients (62.90%) to have bilateral involvement, which statistically significant. In another study done by Arvind *et al.*,[12] 108 (3.8%) were found to have PXF syndrome, with unilateral disease in 53 (49.1%) and bilateral in 55 (50.9%) subjects and is not statistically significant. This is expected as the disease process is invariably bilateral pathologically but clinical bilateral involvement is evidenced after 5-10 years of unilateral clinical presence. Meanwhile unilateral presence cannot be confirmed only with clinical finding since the histopathological are confirmative of the condition of whether it is unilateral or bilateral which is not done in our study and only clinical presence is take into consideration for classification of laterality. According to WHO criteria of Visual status, 35 (25%) eyes had Near Normal vision, 72 eyes (51.43%) were included in Visually Impaired, 10 eyes (7.14%) had severe visual impairment, 12 (8.57%) eyes had Social Blindness and 11 (7.86%) patients were included in Legal Blind category. Aalia R Sufi *et al.*,[13] found that decrease in visual acuity in patients with PXF. Study done by Thomas *et al.*,[14] has found the prevalence of blindness with PXF to be 15.1%. Result of both the study are consistent with our study. Visual impairment in patients with PXF may be attributed to several possible mechanisms. Pericellular accumulating PXF material disrupts and destroys the basement membrane and the cells involved. The cell-matrix interaction may adversely affect the cells leading to cellular dysfunction and eventually cell degeneration known as degenerative fibrillopathy. In some cases of PXF, the patient may complain of impaired visual acuity or changes in their perceived visual field. This visual problem occurs when the granular flakes become enmeshed in trabecular meshwork and block normal drainage of aqueous humor leading to increased intraocular pressure and loss of vision. Pseudoexfoliation syndrome is also known to weaken ciliary muscle and adversely affect lens zonules. Rubbing off PXF material from the lens may result in loss of iris pigment, which can lead to transillumination defects. Poor pupillary response to dilatation is a subtle finding in PXF patients, which may adversely affect vision.[6] In study done by Vijayalakshmi *et al.*,[3] pseudoexfoliative material was found on the pupillary margin of iris in 13 patients (22.03%) and on anterior surface of lens in 20 patients (33.89%). In 26 patients (44.06%) material was found on both the areas. Thomas *et al.*,[14] it was present on the pupillary margins of 65 (58.0%) eyes and on the lens of 71(63.4%), only on the lens surface in 48 (42.9%), only on the pupillary margins in 38 (33.9%), and in both locations combined in 26 (23.2%). Similar findings were noted in present study. In study done by C N Gupta[6], out of 120 patients, the range of IOP was 11.2 mm Hg to 26.1 mm Hg with an average IOP reading of 17.38 mmHg. In study by Vijayalakshmi *et al.*,[3] 42 patients (71%) had IOP less than 20 mm Hg, 11 patients (18.6%) had IOP more than 21 mm Hg. 6 patients (10%) presented with glaucomatous disc changes in patients Pseudoexfoliation. Our study findings are also consistent with above studies. Satish *et al.*,[15] studied 500 eyes with Pseudoexfoliation with cataract underwent MSICS with

IOL implantation. They found PCR was seen in 50 patients (27.6%), vitreous loss was seen in 40 patients (22.09%) and Iridodialysis was seen in 4 patients (2.20%). In study of Jawad *et al.*,[16] most common Intraoperative complication was Vitreous loss (10.5 %), PCR (9%), Damage to sphincter pupillae (8%), Retained lens material (6%) Zonular dialysis (4%) present. These results are consistent with the results of our study. Similar results were seen in present study. In study of Praveen *et al.*,[17] the commonest intra-operative complication was Zonular dialysis in 10% and Posterior capsular rupture in 2%. In a study connected by B Ramalakshmi *et al.*,[11] out of 62 patients who underwent cataract extraction with IOL implantation, 5 patients (8.06%) had post op vision of >3/60,14 patients (22.58) had visual acuity between <6/18 – 3/60, 43 patients had postop visual acuity of ≥6/18 which is similar to our study. In a study done by Prachee *et al.*,[18] out of 156 patients of Pseudoexfoliation who underwent cataract surgery, the post-operative visual acuity was ≥ 6/18 in 126 patients (80.76%), 6/18 - 6/36 in 24 patients (15.38%) and ≤ 6/60 in 6 patients (3.84%) which is similar to our study. In the current study, among 140 Pseudoexfoliative eyes, 81 eyes (57.86%) had anterior chamber depth in the range of 2 – 2.5 mm and 59 eyes (42.14%) eyes had anterior chamber depth in the range of 2.6 – 3 mm.We found that complications occurred frequently in Anterior Chamber Depth of 2 - 2.5 mm. All 17 patients with intraoperative complications had ACD in the range of 2 – 2.5 mm with mean ACD of 2.33±0.12mm. Similar results were found by Kuchle *et al.*,[19] that in eyes with Pseudoexfoliation syndrome and anterior chamber depth of less than 2.5mm, the risk of intraoperative complications was 13.4% when compared to eyes in which the anterior chamber depth is 2.5mm or more the risk of intraoperative complications is significantly reduced to 2.8%. The mean anterior chamber depth in eyes with complications is 2.36 ± 0.44 SD compared to eyes without complications in which the mean ACD was 2.74 ± 0.52mm. In study done by Gulsum *et al.*,[20] patient with poor pupil dilation intraoperative complications was seen in 60 (75%) of the patients with Pseudoexfoliation and 17 (11.7%) of the control patients. Thus, frequency of poor intraoperative pupillary dilation was significantly higher in the PXF group compared to controls ($p<0.001$). In another study done by Chevuturu *et al.*,[21], out of 76 patients, 27 (35.5%) had poor pupillary dilatation and higher intraoperatively complications. In study done by Ramalakshmi *et al.*,[11] higher incidence of intraoperative complications like zonular dehiscence in 5 cases (8.06%), PCR (9.67%) and vitreous loss in 8.06% were more where pupil diameter between 3-5mm which was found to be statistically significant (<0.05%) Reduction of stromal elasticity by accumulation of Pseudoexfoliation material plays important role in poor mydriasis and poor postoperative outcomes. Limitations of present study was small sample size; findings of present study need to be confirmed with a larger study population.

CONCLUSION

There is significant association between Pseudoexfoliation syndrome and age, male preponderance and bilateral involvement of eyes. Pseudoexfoliative material is most commonly seen involving lens followed by other anterior eye structures. MSICS provides significant improvement in visual outcome in patients with Pseudoexfoliation syndrome with cataract. Detection of Pseudoexfoliation preoperatively prepares us for the intraoperative complications and allows for prevention of these complications. Thus, it is recommended that each eye with Pseudoexfoliation must be individually approached.

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