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Original Article

Ophthalmology Section

Clinical Characteristics of Pseudoexfoliation Syndrome and Pseudoexfoliation Glaucoma Patients: A Retrospective Cross-sectional Study

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ABSTRACT

Introduction: Pseudoexfoliation (PEX) is a systemic disease characterised by the accumulation of dandruff-like fluffy deposits of fibrillar granular material. It is the most common cause of secondary open angle glaucoma. Pseudoexfoliation Glaucoma (PXG) is typically associated with rapid visual field loss, greater severity of optic neuropathy and pressure spikes.

Aim: To evaluate the clinical characteristics of Pseudoexfoliation Syndrome (PXS) and PXG in the eastern part of Uttar Pradesh.

Materials and Methods: This retrospective cross-sectional study was done on a total of 40 patients with 78 eyes, at Sitapur Eye Hospital, Sitapur, Uttar Pradesh, India. The authors reviewed the medical records database to identify all patients aged 35 years or older with PXG or PXS who attended the outpatient clinic between January 1, 2020 and January 31, 2021. Ethical approval was obtained from the Institutional Review Board at Sitapur Eye Hospital, Sitapur. Continuous variables were calculated by Mann-Whitney U test student's t-test and qualitative variables using the chi-square test. The p-value <0.05 was considered significant.

Results: A total of 40 patients with 78 eyes were diagnosed as having PXG or PXS. The mean age of study patients was 66.12±11.63 years. The male to female ratio was 2.64:1. The average Intra Ocular Pressure (IOP), Cup:Disc ratio was more in the patients having PXG (p<0.001) as compared to PXS. The PEX at the pupillary margin and pupillary ruff atrophy was more in PXG. The bilateral involvement of disease was observed in most of the patients.

Conclusion: The spectrum of PEX includes a detailed ocular and systemic examination. Dilated anterior segment examination should be emphasised in routine practice to prevent missed diagnosis of early PEX patients, thus, resulting in decreased glaucomatous damage.

Keywords: Corneal changes, Sampaolesi's line, Target sign

INTRODUCTION

The PEX is characterised by the deposition of distinctive fibrillary extracellular material in the ocular and systemic tissues. Lindberg, a Finnish ophthalmologist, in 1917 was the first one to describe the PXS [1]. The basic pathogenesis of PXS remains around microfibrillopathy, oxidative stress, polymorphism in the Lysyl Oxidase Like-1 (LOXL-1) gene which leads to increased matrix degradation and accumulation of elastotic exfoliative material [2,3]. The prevalence of PXS is different across different population groups [4]. PXS tends to occur much less frequently in Asian populations but is maximally found in Scandinavian countries, Greece, and the sub-Saharan African region [5-7]. Over time, the PXS gets converted in PXG. Approximately, 5% of patients with PXS progress and convert into PXG over five years, 15% at 10 years, and 15-year risk of PXG in 60% of patients [8-10].

Various ocular and extraocular sites of Pseudoexfoliative Material (PXM) deposition in the anterior segment include conjunctiva, corneal endothelium, lens capsule epithelium, iris epithelium, trabecular meshwork, extraocular muscles, vortex veins, posterior ciliary arteries, and central retinal artery and vein passing through the optic nerve sheath [11-13]. Multiple pathological changes like corneal endothelium decompensation, poor pupillary dilation, phacodonesis, secondary open angle, and secondary angle closure glaucoma develop due to deposition of PXM material [14]. Systemic sites include liver, heart, lung, gallbladder, kidney, skin, and cerebral meninges leading to various systemic manifestations of the PXS and PXG spectrum [15,16]. On literature search, no study was found to determine the clinical profile and characteristics of PXS and PXG patients in this region. Hence, the present study was conducted on patients attending Sitapur Eye Hospital, Sitapur.

MATERIALS AND METHODS

The present retrospective cross-sectional study has been carried out at Sitapur Eye Hospital, Sitapur, Uttar Pradesh, India. The study was a retrospective review of patients with PXS and PXG. The authors reviewed the medical records database system at the Sitapur eye hospital Sitapur, Uttar Pradesh, India to identify all new and consecutive patients aged 35 years or older with PXS and PXG, who attended the eye outpatient clinic between January 1, 2020 and January 31, 2021. The duration of data analysis was three months. The study adhered to the tenets of the Declaration of Helsinki and Ethical approval (EC/OA/02/2021) was obtained from the Institutional Review Board at Sitapur Eye Hospital, Sitapur.

Inclusion criteria: Medical records of patients giving willful written consent, eyes with PXM and pseudophakic patients having a history of cataract surgery were included in the study.

Exclusion criteria: Medical records of patients with known case or family history of primary glaucoma and other causes of secondary glaucoma, Existing or previous optic disc/nerve disorders, Patients with age <35 years and refusing consent were excluded from the study.

Study Procedure

The PXS was considered present when typical PXM was present at the pupil, lens surface, or other intraocular structures. When no PXM was seen in one eye after pupil dilation, the eye was

considered clinically non PXS. PXG was defined as the presence of PXS and clinical glaucomatous optic neuropathy manifested as focal or diffuse neuroretinal rim thinning, retinal nerve fibre layer defects, or peripapillary atrophy, with corresponding glaucomatous visual field defects manifested, or retinal nerve fibre layer defects on Optical Coherence Tomography (OCT) with or without increased IOP. The PXS patients with prior surgical intervention for glaucoma or currently receiving glaucoma topical medications and meeting the above definition of glaucoma were considered PXG cases.

Clinical records were reviewed in detail for presenting complaints, detailed ocular and systemic history, Best Corrected Visual Acuity (BCVA) taken by Snellen's chart and converted to corresponding log Minimal Angle of Resolution (logMAR), IOP (by Goldmann applanation tonometer), Central Corneal Thickness (CCT), complete slit-lamp biomicroscopic examination (pre and postmydriasis), gonioscopy (using Zeiss 4-mirror goniolens), optic nerve head evaluation with +90/+78 D lens, indirect ophthalmoscopy with +20 D lens for peripheral retina evaluation, and Humphrey threshold 24-2 and 10-2 visual field analysis depending on the severity of glaucoma. Grading used for gonioscopy was based on structures visualised. Swept Source-Optical Coherence Tomography (SS-OCT) (DRI OCT-1, Topcon, Tokyo, Japan) was utilised for RNFL thickness scans. Patients with incomplete records were excluded.

STATISTICAL ANALYSIS

The data was analysed using Statistical Package for the Social Sciences (SPSS) version 21.0. Continuous variables were presented as mean±SD and were calculated by Mann-Whitney U test and student's t-test. Categorical variables were presented in number and percentage (%). Qualitative variables were calculated using the chi-square test. The p-value of <0.05 was considered significant.

RESULTS

Out of 1055 patients, examined in glaucoma specialty clinic during one year, a total of 40 patients with 78 eyes (two patients were single eyed) were diagnosed as having either PXS or PXG. Out of 40 patients, 17 patients (33 eyes) were diagnosed as PXS and 23 patients (45 eyes) as PXG. There were 29 (72.5%) males and 11 (27.5%) patients were female.

The mean age of total study patients was 66.12±11.63 years (range, 35-81 years) with a male to female ratio of 2.64:1. The average age of PXS and PXG patients was 68.21±12.64 and 64.58±10.70 years, respectively. There was no statistically significant difference between the age of PXS and PXG patients (p=0.064). A total of 11 patients were below the age of 60 years, 13 patients were between 61-70 years age group, and 16 patients were above 70 years of age. Demographic characteristics are summarised in [Table/Fig-1].

The average BCVA (log MAR) of all the patients was 0.89±0.09 while among PXS and PXG patients, it was 0.45±0.29 and 1.22±1.06, respectively (p=0.007). The mean Central Corneal Thickness (CCT) (µm) of all the study patients was 527.65±8.71 while for PXS and PXG patients, it was 530.39±8.19 and 525.64±8.63, respectively (p=0.016) [Table/Fig-2]. The average baseline IOP in all study patients was 23.74±9.38 mmHg (range 10-56 mmHg). The average IOP in PXS and PXG patients were 16.15±2.28 mmHg and 29.31±8.67 mmHg, respectively (p<0.001) [Table/Fig-2]. The average baseline MD and average Visual Field Index (VFI) (%) of all study patients on Humphrey visual field analysis were-6.68±9.44 and 72.03±38.25, respectively. In PXS and PXG group average baseline MD were -0.90±1.18 and -12.65±10.49, respectively (p<0.001). The VFI (%) were 96.91±1.91 and 53.78±41.86 in PXS and PXG groups, respectively (p<0.001) [Table/Fig-2].

Out of 78 eyes, 28 eyes (four PXS and 24 PXG) had PXM at corneal endothelium, six eyes (two PXS and 4 PXG) had diffuse endothelial pigments, two eyes had Krukenberg spindles present only in the PXG group, and 42 eyes (27 PXS and 15 PXG) did not had any corneal changes. The overall p-value=0.001 for the corneal changes was statistically significant among PXS and PXG groups [Table/Fig-3]. The PXM was present in 72 eyes (30 PXS and 42 PXG) at the pupillary margin. Pupillary ruff atrophy was present in 31 eyes (five PXS and 26 PXG) with a statistically significant p-value=0.0001. Iris Trans-Illumination Defects (ITD) were present only in 10 eyes out of 78 eyes and absent in 68 eyes. The PXM at the Anterior Lens Capsule (ALC) in the pupillary area was present in 50 eyes (17 PXS and 33 PXG). PXM at the ALC in retro iris area was seen in 42 eyes (12 PXS and 30 PXG) with a statistically significant p-value=0.008.

Variables	Total		Diagnosis				Student's t-test value*	p-value
			PXS		PXG			
Total no. of patients	40		17		23		NA	NA
Total no. of eyes	78		33		45			
Male/Female	29/11		10/7.0		19/4.0			
Male: Female ratio	2.64:1		1.43:1		4.75:1			
	Mean	SD	Mean	SD	Mean	SD		
Age (years) Z value*	66.12	11.63	68.21	12.64	64.58	10.70	-1.855*	0.064
Age- male	67.19	10.61	69.80	10.31	65.78	10.63	1.375	0.175
Age- female	63.19	13.89	65.77	15.72	59.00	9.77	1.089	0.290

[Table/Fig-1]: General characteristics of study patients.
*student t-test

Parameters	Total		PXS		PXG		Z-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
BCVA logMAR	0.89	0.09	0.45	0.29	1.22	1.06	-2.721	0.007
IOP	23.74	9.38	16.15	2.28	29.31	8.67	-6.093	0.001
CCT*	527.65	8.71	530.39	8.19	525.64	8.63	2.454*	0.016
CDR	0.61	0.25	0.39	0.11	0.77	0.20	-6.488	0.001
HVF mean deviation	-6.68	9.44	-0.90	1.18	-12.65	10.49	-5.499	0.001
Visual field index	72.03	38.25	96.91	1.91	53.78	41.86	-5.713	0.001

[Table/Fig-2]: Baseline evaluation in study patients.
BCVA: Best corrected visual acuity; IOP: Intra-ocular pressure; CCT: Central corneal thickness; CDR: Cup:Disc ratio; HVF: Humphrey visual fields; Z value=Mann-Whitney U test value
*student t-test value

Parameters		Diagnosis				Total	Chi-square value	p-value
		PXS		PXG				
Corneal changes	PXM on corneal endothelium	4	12.1%	24	53.3%	28	18.984	0.001
	Diffuse pigmentation	2	6.1%	4	8.9%	6		
	Krukenberg spindles	0	0.0%	2	4.4%	2		
	None	27	81.8%	15	33.3%	42		
PXM at pupillary margin	Present	30	90.9%	42	93.3%	72	0.158	0.691
	Absent	3	9.1%	3	6.7%	6		
Pupillary ruff atrophy	Present	5	15.2%	26	57.8%	31	14.445	0.0001
	Absent	28	84.8%	19	42.2%	47		
Iris transillumination defects	Present	2	6.1%	8	17.8%	10	2.339	0.126
	Absent	31	93.9%	37	82.2%	68		
PXM on Anterior Lens Capsule (ALC) in pupillary area	Present	17	51.5%	33	73.3%	50	3.938	0.047
	Absent	16	48.5%	12	26.7%	28		
PXM on anterior lens capsule in retro iris area	Present	12	36.4%	30	66.7%	42	7.035	0.008
	Absent	21	63.6%	15	33.3%	36		
Grade of cataract	Nulear Scelorsis 1	4	12.12%	5	11.1%	9	2.636	0.756
	Nuclear Sclerosis 2	15	45.45%	20	44.4%	35		
	Nuclear Sclerosis 3	10	30.30%	15	33.3%	25		
	Nuclear Sclerosis 4	1	3.03%	3	6.7%	4		
	Posterior sub capsular	13	39.39%	10	22.2%	23		
	None	3	9.09%	2	4.4%	5		
Phacodonesis	Present	2	6.1%	11	24.4%	13	4.633	0.031
	Absent	31	93.9%	34	75.6%	65		

[Table/Fig-3]: Anterior segment findings in study patients.
*PXM: Pseudoexfoliative material
*chi-square test

In the present study, 9 eyes (11.53%) had nuclear sclerosis 1 grade cataract, 35 eyes (44.87%) eyes had nuclear sclerosis grade 2 cataract, 25 eyes (32.01%) had nuclear sclerosis grade 3 cataract, 4 eyes (5.12%) had nuclear sclerosis grade 4 cataract, 23 eyes (29.48%) had posterior subcapsular cataract along with various nuclear grades of cataract. Five, eyes (6.41%) had no cataractous changes. Phacodonesis was present only in 13 eyes (2 PXS and 11 PXG) with a statistically significant p-value=0.031, and absent in 65 eyes out of 78 eyes [Table/Fig-3]. Two eyes of PXG presented with Shaffer's grade 0 and acute angle closure attack, four eyes (two PXS and two PXG) had Shaffer's grade 1, six eyes (two PXS and four PXG) with grade 2, 36 eyes (15 PXS and 21 PXG) with grade 3 open angles, and 30 eyes (14 PXS and 16 PXG) with grade 4 open angles were present.

Twenty five eyes (eight PXS and 17 PXG) had Spaeth's grade 4 angle pigmentation, 30 eyes (12 PXS and 18 PXG) had grade 3 angle pigmentation, and 11 eyes had each grade 2 and grade 1 angle pigmentation. Only one eye of PXS had no angle pigmentation. The PXM in angle was present in 27 eyes (eight PXS and 19 PXG) and Sampaolesi's line was visualised in 18 eyes (seven PXS and 11 PXG) out of 78 eyes [Table/Fig-4]. On fundus examination 45 (57.69%) eyes had Cup:Disc (C:D) ratio of 0.6 or less, 6 (7.69%) had C:D ratio of 0.61-0.79 and 27 (34.61%) eyes were having C:D ratio of 0.8 or more. The average C:D ratio in all study patients was 0.61±0.25. The C:D ratio of PXS and PXG patients, were 0.39±0.11 and 0.77±0.20, respectively, (p=<0.001) [Table/Fig-2].

Parameters		Diagnosis				Total	Chi-square value	p-value
		PXS		PXG				
Angle grade (Shaffer's)	Grade 0	0	0.0%	2	4.4%	2	2.001	0.736
	Grade 1	2	6.1%	2	4.4%	4		
	Grade 2	2	6.1%	4	8.9%	6		
	Grade 3	15	45.5%	21	46.7%	36		
	Grade 4	14	42.4%	16	35.6%	30		
Angle pigmentation (Spaeth's grade)	0 (None)	1	3.0%	0	0.0%	1	6.847	0.144
	1+ (Minimal)	8	24.2%	3	6.7%	11		
	2+ (Mild)	4	12.1%	7	15.6%	11		
	3+(Moderate)	12	36.4%	18	40.0%	30		
	4+ (Intense)	8	24.2%	17	37.8%	25		
PXM in angle	Present	8	24.2%	19	42.2%	27	2.719	0.099
	Absent	25	75.8%	26	57.8%	51		
Sampaolesi's line	Present	7	21.2%	11	24.4%	18	0.112	0.738
	Absent	26	78.8%	34	75.6%	60		

[Table/Fig-4]: Gonioscopic evaluation in study patients.
*chi-square test

DISCUSSION

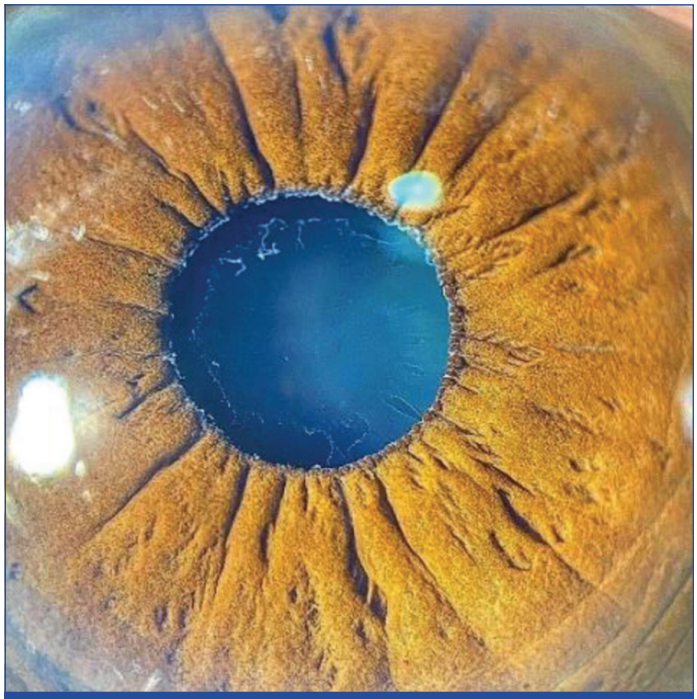
The objective of the present study was to evaluate the clinical characteristics of PXS and PXG patients at a tertiary eye care centre in Eastern Uttar Pradesh. The prevalence of PEX is presumed to have extensive variation by previous reports. The worldwide prevalence of PEX ranges from 0.3% to 22.1% according to Ringvold A [17]. Sood NN, Lamba PA and Giridhar A; Arvind H et al., Ramkrishnan R et al., have also reported a variable prevalence rate of PXS and PXG between 1.8% and 7.4% and 7.5% and 13% [18-21]. A plausible explanation of varied prevalence cannot be attributed to a single factor but is a result of cumulative differences in ethnicity, geographical location, race, age, gender [14]. Distinct study designs, cohort size, examination techniques, and diagnostic criteria may also develop intra-regional variation in prevalence presuming similar racial and genomic makeup. Significant numbers of PEX cases may remain undiagnosed due the failure to dilate the pupil required for examination by slit-lamp biomicroscopy. Nearly, 60-80% of undiagnosed cases of PEX have been reported by the advanced ophthalmology centres [22].

In the present study, the mean age of total study patients was 66.12±11.63 years. The mean age in the study conducted by Arvind H et al., was 64.7±9.63 years, Triveni C et al., was 68.47±9.37 years. Philip SS et al., was 65.1±8.0 years. In the present study, out of 40 patients, there were 11 patients (27.5%) below 60 years of age and 29 patients (72.5%) above 60 years of age. This was consistent with previous study reports suggesting an increased prevalence of PEX along with the age [20,23,24].

The authors found male preponderance with 29 (72.5%) males and 11 (27.5%) females, with a male:female ratio of 2.64:1. Triveni C et al., also found male dominance with 66.02% followed by females with 33.98% [23]. Joshi RS and Singanwad SV, found males (52.7%) and females (47.3%) [25]. In most of the studies, the predominance of males was more as compared to females. High ultraviolet exposure due to increased outdoor activity time may be one of the reasons for male predominance in the Indian population [23,25].

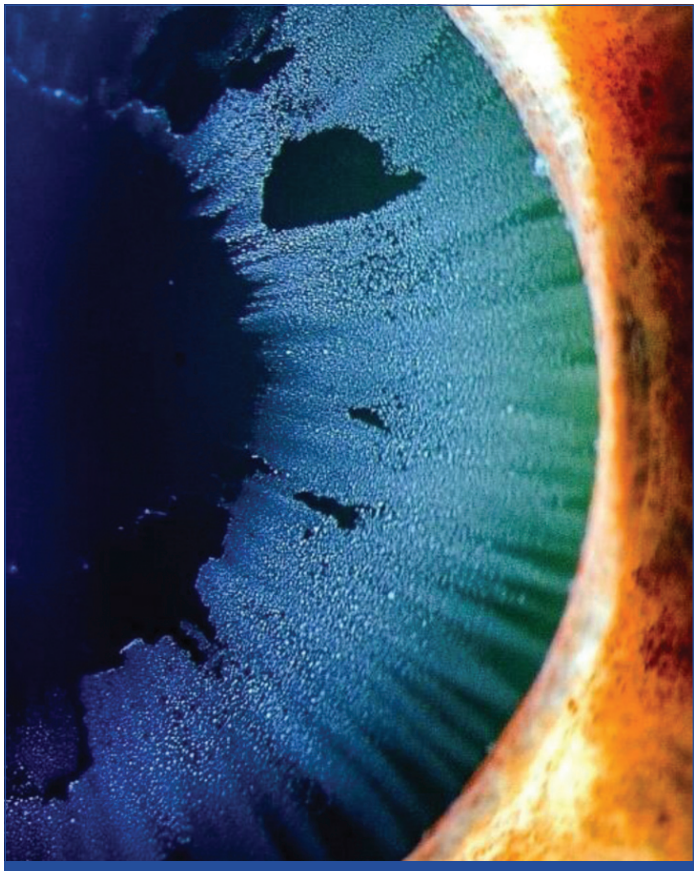
The mean CCT (µm) of all the study patients was 527.65±8.71 while for PXS and PXG patients, it was 530.39±8.19 and 525.64±8.63, respectively (p=0.016), signifying a thinner CCT in PXG and higher susceptibility of high IOP in these cases. Zheng X et al., concluded that the presence of the PXM induces apoptosis of corneal stromal keratocytes and leads to the depletion of its extracellular structure [26]. In the current study, 24 eyes (53.3%) of PXG and 4 eyes (12.1%) of PXS had PXM at corneal endothelium, 2 eyes (6.1%) of PXS and 4 eyes (8.9%) of PXG had diffuse endothelial pigments, 2 eyes (4.4%) had Krukenberg spindles present only in PXG group. The overall p-value=0.001 for the corneal changes was statistically significant suggesting more predilection of these corneal changes in PXG cases. In a study conducted by Triveni C et al., 17.90% of eyes had pigments on the corneal endothelium [23]. Sharma PD et al., found 49.4% of patients showed pigments on the corneal endothelium [27].

Pseudoexfoliative Material was present in 30 eyes (90.9%) of PXS and 42 eyes (93.3%) of PXG at the pupillary margin [Table/Fig-5]. Al Saleh SA et al., found 62.3%, Triveni C et al., found 100% patients, Sharma PD et al., 84.7% patients, patients having PXM on the pupillary margin [14,23,27]. Pupillary ruff atrophy was present in 5 eyes (15.2%) of PXS and 26 eyes (57.8%) of PXG with a statistically significant p-value of 0.0001. Thus, the presence of pupillary ruff atrophy may be used as an indicator of increased damage and the likelihood of increased conversion of PXS to PXG. In a retrospective study performed by Rao A and Padhy D, 59.82% of patients were presented with degranulation of pupillary ruff in patients with PEX [28]. Sharma PD et al., found 74.7% of eyes in the study showing degranulation of pupillary ruff [27]. The ITD's were present only in two eyes (6.1%) of PXS and 8 eyes (17.8%) of PXG and absent in 68 eyes. In a study conducted by Triveni C et al., ITD's were present in 8.90% of cases [23].

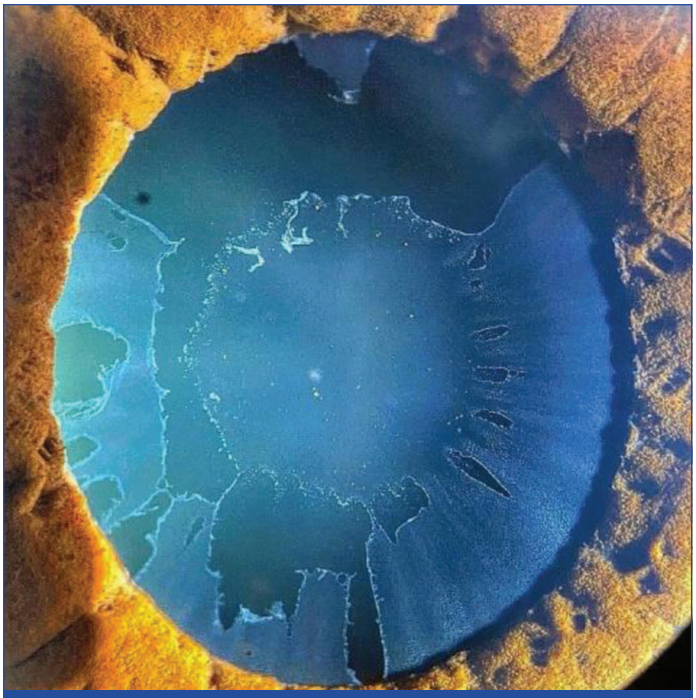


[Table/Fig-5]: Pseudoexfoliation (PEX) material at pupillary margin.

The authors found that PXM at ALC in the pupillary area was present in 17 eyes (51.5%) of PXS and 33 eyes (73.3%) of PXG. The PXM at ALC in retro iris area was seen in 12 eyes (36.4%) of PXS and 30 eyes (66.7%) of PXG with a statistically significant p-value of 0.008 signifying the presence of PXM in retro iris area more in PXG cases as compared to PXS cases [Table/Fig-6,7]. In a previously conducted study by Triveni C et al., 65.13% of eyes had ALC PXF in the pupil [23]. In the study done by Sharma PD et al., 91.7% showed PEX material on the anterior capsule of the lens [27].



[Table/Fig-6]: Pseudoexfoliation material at Anterior Lens Capsule (ALC).



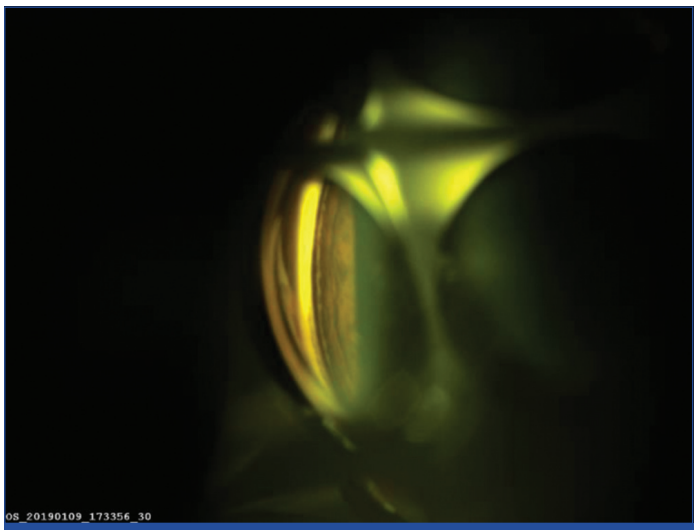
[Table/Fig-7]: Target Sign: The typical pattern of deposition of pseudoexfoliative material on Anterior Lens Capsule (ALC) is named Target sign.

In the present study, a maximum of 35 eyes (44.87%) had NS2 grade cataract followed by 25 eyes (32.01%) had NS3 grade cataract, 9 eyes (11.53%) had NS1 grade cataract, 4 eyes (5.12%) had NS4 grade cataract. Twenty three eyes (29.48%) had a posterior subcapsular cataract along with various nuclear grades of cataract. This is consistent with previous reports establishing an association between PEX and cataract [29].

Phacodonesis was present only in 2 eyes (6.1%) PXS and 11 (24.4%) PXG with a statistically significant p-value of 0.031, suggestive of increased cataract related intraoperative complications in PXG cases as compared to PXS cases. It was found that a higher percentage of phacodonesis cases in the present study as compared to Triveni C et al., and Sharma PD et al., who found phacodonesis in 8.23% and 4.46% of the total PEX cases, respectively [23,27]. The variation may be due to the difference in PXM deposition on zonules, duration of pathology, associated cataractous changes, across the studies.

The PXF is the most common identifiable cause of secondary open-angle glaucoma and is usually associated with higher IOP levels. There is more risk of developing glaucoma in PXF patients as compared to non PXF patients for the same levels of high IOP [29]. Out of total study patients, 17 (42.5%) patients (PXS) had normal IOP and 23 (57.5%) patients (PXG) had raised IOP. The average baseline IOP in all study patients was 23.74±9.38 mmHg (range 10-56 mmHg). The average IOP's in PXS and PXG patients were 16.15±2.28 mmHg and 29.31±8.67 mmHg, respectively (p<0.001). The higher incidence of PXG patients in the present study is contrary to previous reports [14,23,29]. The probable reason for this difference is due to delayed presentation and conversion of cases to PXG, affected overall eye care services due to COVID-19 pandemic, lack of awareness amongst population of our region, small cohort size of the present study, and, the difference in the overall prevalence of glaucoma among different ethnicities.

In the present study, 2 eyes (2.5%) had closed angles in PXG cases, 10 eyes (12.82%) had a narrow angle and, 66 (84.61%) eyes had open angles. These findings are consistent with previous reports endorsing increased incidence of open angle glaucoma in PEX patients [14,23,24]. A total of 55 eyes (70.51%) had moderate to intense angle pigmentation while 22 eyes (28.20%) had mild to minimal pigmentation. Sampaolesi's line was found in only in 18 cases of total PXF spectrum [Table/Fig-8]. Al-Saleh SA et al., found angle pigmentation in the right eye of the 58.7% of patients whereas in the left eye of 53.3% patients, Triveni C et al., found angle pigmentation in 63.4% of patients, and Gungor SG et al., found inferior angle pigmentation in 25 eyes (73.5%) [14,23,30].



[Table/Fig-8]: Sampaolesi's line on gonioscopy.

The PXM in angle was present in 27 eyes (34.61%) out of 78 study eyes. Al-Saleh SA et al., revealed that PXM in the angle was present in 23.9% of the right eye and 14.9% of left eye while Triveni C et al., showed PXM in angle in 27.7% of eyes [14,23]. The C:D ratio of PXG patients was significantly higher than PXS patients. This is because of more neuro-retinal rim thinning in PXG patients. The C:D ratio changes more gradually in large discs. Amongst both the group, PXG group patients had significantly lower MD (p<0.001) and VFI (p<0.001), suggestive of rapid deterioration of their visual function and may often require a multi-modal approach in these patients. The prevalence of PEX varies geographically and also along with age. Incidence of corneal changes and pupillary ruff atrophy is more in PXG as compared to PXS. A detailed dilated slit lamp biomicroscopic examination is a rule in these cases.

Limitation(s)

Potential limitations were the retrospective nature of the study, small cohort and the authors did not establish interdependence of PEX with any systemic illness. Future perspective of the study includes correlating systemic diseases like diabetes mellitus, hypertension, coronary artery disease with severity of pseudoexfoliative spectrum.

CONCLUSION(S)

To conclude, the spectrum of PEX includes a detailed ocular and systemic examination. The prevalence of PEX varies geologically and increases with age. Most of the cases in the present study had bilateral involvement of either PXS or PXG. The visual prognosis in PXG cases was poor as compared to PXS. Pupillary ruff atrophy may be determined as an indicator of progressive and increased damage in these patients. Dilated anterior segment examination should be emphasised in routine practice to prevent missed diagnosis of early PEX patients, thus resulting in decreased glaucomatous damage.

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