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PREVALENCE OF GLAUCOMA IN PSEUDO EXFOLIATION SYNDROME PATIENTS AT A TERTIARY CARE CENTER IN JAMMU & KASHMIR (INDIA)

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ABSTRACT

Pseudo exfoliation syndrome (PEX), an age-related disorder, is a systemic extracellular matrix condition that largely manifests as distinctive ocular characteristics. Glaucoma, a clinical consequence of PEX, in exfoliation syndrome is more severe than primary open-angle glaucoma. Increased intraocular pressures and its diurnal variation are typically higher at diagnosis time, and visual field abnormalities are typically severe in exfoliation glaucoma. The present study was aimed to assess the prevalence of glaucoma in PEX patients who underwent a comprehensive ophthalmic evaluation in a tertiary care centre. An institution-based cross sectional study was conducted in ASCOMS & Hospital, Jammu (India) from June to November, 2023 involving 115 clinically diagnosed PEX patients (190 eyes) of age >50 years. Demographic information related to their age, sex, religion, residence and alcohol addiction was collected and glaucoma in PEX patients, if present, ascertained. The comprehensive ophthalmological evaluation undertaken included recording diurnal variation of tension, gonioscopy and visual field assessment. The study revealed the prevalence of glaucoma as 32.85% among PEX patients with mean intraocular pressure as 17.3 ± 3.7 mmHg. A significant association between glaucoma in PEX patients with age, sex and residence was observed. PEX patients of age-category 61-70 (86.4%), male (40.3%), Hindu (41.7%), urban people (45.3%) and alcohol addicted (42.2%) suffered more from glaucoma. Among the PEX patients having bilateral involvement (65.2%), glaucoma prevailed in 34.7% cases, while glaucoma was recorded in 45.0% of the rest PEX patients showing unilateral involvement. PEX is a major significant risk factor in glaucoma development. The patients suffering from PEX should get frequently examined so as to prevent the risk of glaucoma development.

Keywords: Glaucoma, intraocular pressure, ocular problem, pseudo exfoliation syndrome, vision

INTRODUCTION

The pseudo exfoliation syndrome (PEX) is an age-related disorder linked to open-angle glaucoma (OAG) and ocular hypertension. PEX is characterized by systemic deposition of distinct fibrillar extracellular material in various tissues and organs of body and largely manifests as distinctive ocular characteristics (Turalba *et al*., 2017; Yibekal *et al*., 2021). It is clinically diagnosed through slit-lamp visualization of white, flaky fibrillar (pseudo exfoliative) material on the pupillary edge of iris and the anterior lens capsule (Schlötzer-Schrehardt and Naumann (2006). Conservative estimates indicate the prevalence of PEX all over the world in the range of 1.5 to 40.9% (Arakaki *et al*., 2020;

Kalaycı, 2020), 3.6-34.2% in Europe (Bikboy *et al*., 2020), 1.5 to 22.1% in Asia (Joshi and Singanwad, 2019) and 1.5 to 40.9% in Africa (Idakwo *et al*., 2018). According to the hospital reports the prevalence of PEX in India ranges from 1.87 to 13.5% (Thomas *et al*. (2003).

The PEX may affect single or both the eyes and is closely linked to the increased intraocular pressures (IOP) and the subsequent onset of pseudo exfoliation glaucoma (PEG) in up to 44%, making it the most widely recognized cause of secondary open-angle glaucoma (Jammal *et al*., 2021). Globally, glaucoma affects 60 million people and is responsible for around 12% of global blindness (Dineen *et al*., 2007). An increased risk of problems, including capsular bag rupture, zonular dialysis, and vitreous loss, may be present in PEX eyes because they dilate slowly and have unstable lens zonules (Jeng *et al*., 2007; Plateroti *et al*., 2015). The trabecular meshwork's gaps are blocked by pseudo-exfoliative material, which encourages the buildup of pigment and cellular debris. As a result, the channels through which the aqueous humour typically outflows into the Schlemm's canal become blocked. This is considered to be the root cause of persistently elevated IOP and the onset of pseudo exfoliation glaucoma (Plateroti *et al*., 2015). IOP of exfoliative eye is around 2 mm Hg higher than IOP of non-exfoliative fellow eye in unilateral exfoliation syndrome (Vesti and Kivelä, 2000; Un and Sonmez, 2023). It has been demonstrated that the clinical course of glaucoma in exfoliation syndrome is more severe than that of primary open-angle glaucoma (POAG) [Nakano *et al*., 2020]. IOP and its diurnal variation are typically higher at the time of diagnosis, and the visual field abnormalities are typically more severe in exfoliation glaucoma than in POAG (Yarangümeli *et al*., 2006; Tomczyk-Socha *et al*., 2023). Thus, the present study was undertaken to assess the prevalence of glaucoma in pseudo exfoliation syndrome patients at ASCOMS & Hospital Jammu (India).

MATERIALS AND METHODS

The present prospective cross-sectional study was conducted in the Department of Ophthalmology, ASCOMS & Hospital, Jammu (India) for a period of six months (June to November 2023) after securing the ethical permission from the Institutional Ethical Committee vide their communication No. ASCOMS/PS/IRC/ 193-195/EC/444 dated 22-05-2023. A total of 115 patients (190 eyes) were included in the study after taking their informal consent. A detailed history of selected patients was taken, and their comprehensive ocular evaluation performed in the Out-Patient Department. All the patients were followed up.

Inclusion and exclusion criteria

The patients of > 50 year's age and the patients diagnosed with pseudo exfoliation syndrome were included in the study. However, the patients with any systemic or ocular co-morbidity, or having history of glaucoma, or with previous ocular surgery or using systemic drugs that may lower IOP (most importantly beta blockers) were discarded from the study, Also, the patients with previous history of ocular trauma or those unwilling to participate and those who didn't attend follow up were excluded from the study.

Data collection and analysis

The data of patients, selected as per the set inclusion and exclusion criteria, was recorded in Microsoft Excel sheet. The data was collected from participants with the help of a preformed proforma consisting of all the details *viz*., gender, age, religion, residence, past systemic illness/ ophthalmic history, alcoholic addiction, etc. Pseudo exfoliation glaucoma was diagnosed on the basis of pseudo exfoliative material on slit lamp examination, IOP measurement, glaucomatous cupping on fundus examination, pigmentation of trabecular meshwork on gonioscopy, glaucomatous field defects on perimetry. The IOP patients were grouped into three categories *viz*., < 20, 21-30 and > 30 mmHg. The data was tabulated, organized, analyzed and interpreted in both descriptive and inferential

statistics i.e. frequency and percentage distribution, χ^2 (Chi square) and paired 't' test, as per requirement, by using statistical package for Social Science Software (SPSS), version 22.0. The continuous variables of study subjects were described in terms of means and analyzed by ANOVA in respect of more than 2 groups. A probability level of p value $\leq$ 0.01 was considered as statistically significant.

RESULTS AND DISCUSSION

In the present study 115 clinically diagnosed pseudo exfoliation syndrome (PEX) patients attending the Eye Outpatient Department were included. The majority of patients suffering from PEX were in the age group 61-70 years (40.0%), followed by 71-80 years (33.9%) [Table 1; Fig. 1]. The majority of subjects were males (58.3%) and Hindus (62.6%) with male to female ratio of 1.40: 1.00. Further, most of the subjects were of urban background (55.7%) while 44.3% were living in rural areas and only 39.1% of patients were alcoholic (Fig. 2).

Table 1: Age-related frequency distribution and the prevalence of glaucoma in the patients suffering from PEX (n = 115)

Age category	PEX patients		Glaucoma in PEX patients	
(years)	Number	%age	Frequency	Prevalence (%)
51-60	14	12.2	3 (6.8%)*	21.4
61-70	46	40.0	18 (40.9%)	39.1
71-80	39	33.9	16 (36.4%)	41.1
81-90	13	11.3	6 (13.6%)	46.2
> 90	3	2.6	1 (2.3%)	33.0
Total	115	-	44	38.3
Mean $\pm$ S.E.	69.7 $\pm$ 8.6	-	67.1 $\pm$ 7.3	-
Standard deviation	11.3	-	9.4	-
t-test (0.01%)	p = 0.85	-	p = 0.71	-

*The values in brackets indicate the overall percentage of glaucoma patients in category group out of the total glaucoma patients

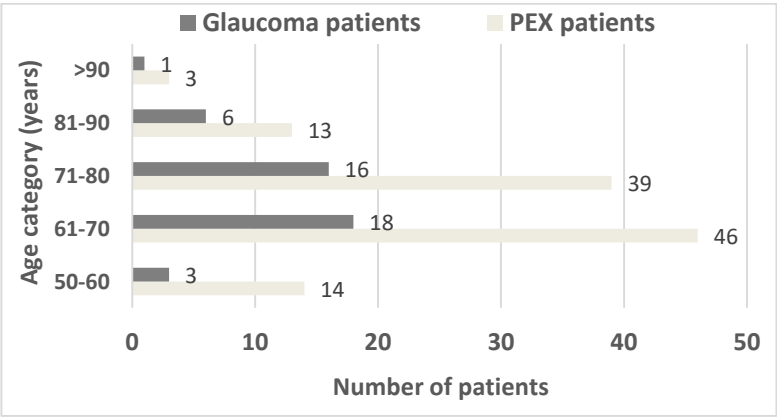

Fig. 1: Frequency distribution and prevalence of glaucoma in PEX patients

Most PEX patients showed bilateral (65.2%) involvement while only 34.8% patients had unilateral involvement (Table 2). The study showed that the glaucoma was present in 44 pseudo exfoliation syndrome patients revealing the overall mean glaucoma prevalence of 38.3% in PEX patients. The majority of patients diagnosed with glaucoma were in the age category of 61-70 and 71-80 years (40.9 and 36.4%, respectively). A significant association was observed between the prevalence of glaucoma and age-category (p = 0.001). Of the glaucoma patients 61.4% were male and 68.2% were Hindus while Muslims and Sikhs comprised of 15 9% each. About 65.9% glaucoma patients had rural background while 56.8% were non-alcoholic.

Table 2: Sex, residence, religion, alcohol addiction and laterality related distribution of glaucoma patients suffering from PEX (n = 115)

Variables	PEX patients		Glaucoma patients in PEX patients		Test of significance
	Number	%age	Frequency	Prevalence (%)	
Sex					
Male	67	58.3	27 (61.4%)	40.3	$\chi^2 = 0.266$; df = 1; $p = 0.192$
Female	48	41.7	17 (38.6%)	35.4	
Residence					
Urban	64	55.7	29 (65.9%)	45.3	$\chi^2 = 0.387$; df = 1; $p = 0.321$
Rural	51	44.3	15 (34.1%)	29.4	
Religion					
Hindu	72	62.6	30 (68.2%)	41.7	$\chi^2 = 0.406$; df = 2; $p = 0.291$
Muslim	23	20.0	7 (15.9%)	30.4	
Sikh	19	16.5	7 (15.9%)	38.8	
Alcohol addiction					
Alcoholic	45	39.1	19 (43.1%)	42.2	$\chi^2 = 0.318$; df = 1; $p = 0.286$
Non-alcoholic	70	60.9	25 (56.8%)	35.7	
Laterality					
Unilateral	40	34.8	18 (40.9%)	45.0	$\chi^2 = 0.578$; df = 1; $p = 0.659$
Bilateral	75	65.2	26 (59.1%)	34.7	

*The values in brackets indicate the overall percentage of glaucoma patients out of the total glaucoma patients.

A significant association was found between the prevalence of glaucoma and sex ($p = 0.002$).

The critical perusal of Table 1 revealed that 77.3% PEX patients in age group 61-80 years suffered from glaucoma; while the prevalence of glaucoma in male and female PEX patients was 40.3 and 35.4%, respectively. Among urban PEX patients, glaucoma prevalence was 45.3% while in rural PEX patients its prevalence was only 29.4%. The prevalence of glaucoma in Hindu PEX patients was 41.4%, followed by Sikhs (38.8%) and Muslims (30.4%). Similarly, glaucoma prevalence in alcohol addicted PEX patients was 42.2% while its prevalence was only 35.7% in non-alcoholic PEX patients. Of the PEX patients showing unilateral involvement, glaucoma was diagnosed in 42.5%, while amongst the PEX patients showing bilateral involvement 36.0% suffered from glaucoma. The overall mean intraocular pressure (IOP) of the diagnosed glaucoma patients was 17.3 mmHg (Table 3). Most of the glaucoma patients (70.5%) had IOP < 20 mmHg while only 6.8% patients had IOP > 30 mmHg.

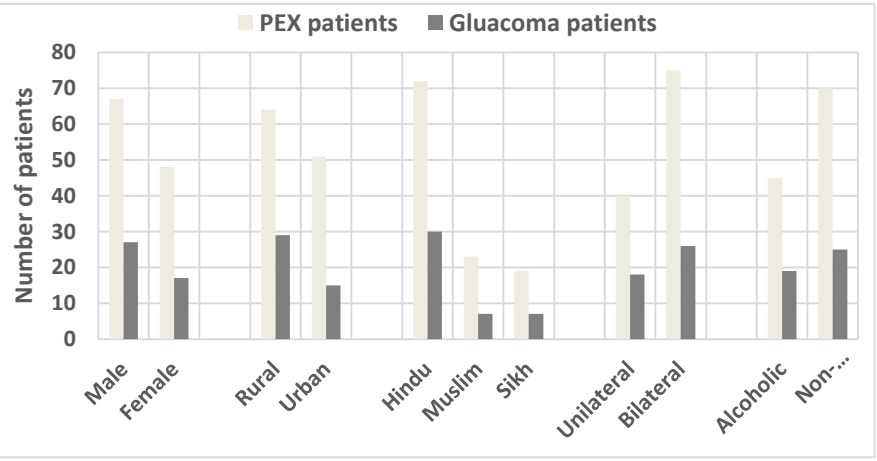

Fig. 2: Sex, residence, religion, laterality and alcoholic addiction related distribution of glaucoma patients suffering from PEX

PEX is mostly prevalent in older people. In present study the majority of the patients were in the age group of 61-80 years (73.9%) with majority of the study subjects living in urban area (55.7%) and belonging to the Hindu community. The study revealed that gender-wise males were more affected by PEX than females, with male: female ratio of 1.40:1.00, which may be attributed to the

Table 3: Intra ocular pressure (IOP) of the patients diagnosed with glaucoma

IOP (mmHg) category	No. of patients	Mean IOP observed (mmHg)	Test of significance
< 20	31 (70.5)*	13.8 ± 3.9	$\chi^2 = 45.349$; df = 2; $p < 0.001$
21-30	10 (22.7)	24.2 ± 4.1	
> 30	3 (6.8)	30.6 ± 1.8	
Overall mean	-	17.3 ± 3.7	

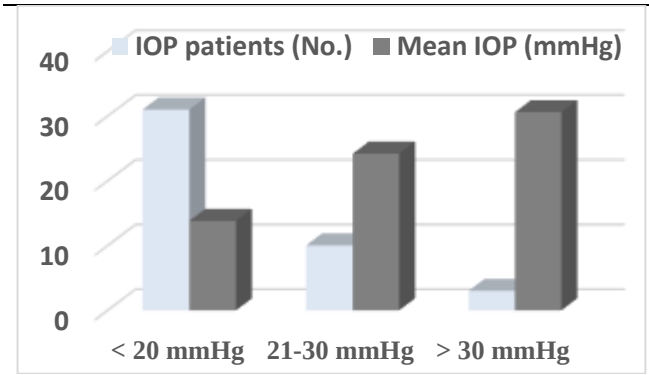

Fig. 3: Mean intraocular pressure (IOP) of the patients diagnosed with glaucoma

fact that men spend most of their time carrying out more outdoor activities in comparison to women. Our results are in agreement with Al Saffar and Ahmad (2019) and Yibekal *et al*. (2021) who reported it as 2:1 and 1.56:1.00, respectively, but contrarily Philip *et al.* (2012) have reported it as 1:1.27. The variation may be attributed to different clinical profiles of patients based on racial, social and regional origin. In present study most of the subjects had bilateral (65.2%) involvement followed by unilateral (34.8%). The mean age of PEX patients was 69.7 ± 8.6 years which is in agreement with Yildirim *et al.* (2017) who found the mean age of PEX patients as 69.1 ± 9.9 years. In present study the unilateral involvement was in 34.8% study subjects and the overall prevalence of glaucoma among the PEX patients was 38.3%.

Worldwide, the most widely recognized type of secondary open-angle glaucoma is pseudo exfoliation syndrome (PEX), which is linked to glaucoma and cataract. The study revealed that the prevalence of glaucoma was 38.3% in the patients suffering from PEX and the mean IOP was 17.3 ± 3.7 mmHg. The findings are consistent with Jammal *et al.* (2021) who reported that the prevalence of glaucoma with pseudo-exfoliation glaucoma 25.4% in patients with PEX. Similarly, Astrom *et al.* (Astrom and Linden, 2007) have reported the overall prevalence of open angle glaucoma as 2.1% and the mean IOP as 17.3 ± 4.5 mmHg. In clinical setting the IOP in the range of 10 to 21 mmHg is considered normal (Bader *et al.*, 2023). In present study the high IOP (> 20 mmHg) with or without glaucoma was 29.5% which is in agreement with Kozart and Yanoff (1982), Kozobolis *et al.* (1997) and Rao *et al.* (2006) who reported the prevalence of high intraocular pressure with or without glaucoma to be in between 22 to 30%.

Warjri *et al.* (2023) observed that PEX more commonly affects males in the age group of seventies from lower socio-economic status and about 25% of the affected eyes are associated with glaucoma and the majority of such eyes have mild or no visual impairment. Al-Saffar and Ahmad (2019) also reported that the majority of patients were in the age group of 70-79 years with glaucoma prevalence of 15.3% among the PEX suffering subject, and also found significant association of glaucoma prevalence with age and sex ($p = 0.001$). Shazly *et al.* (2011) have reported the mean age of study subjects as 68.15 ± 8.16 years with age ranging in between 40-92 years. Our study revealed that the prevalence of PEX is significantly associated with the advanced age ($p = 0.001$). The reason for age-related increase is unknown, though the occurrence of variations in gene expression with age is speculated to be responsible for increase in PEX (Sufi *et al*., 2014; Al-Saffar and Ahmad, 2019). Bilateral PEX was found in 65.2% patients followed by unilateral 34.8%. Glaucoma prevalence was more in alcohol addicted PEX patients (42.2%) as compared to non-alcoholic PEX patients (35.7%).

Conclusion: In present study it was found that the overall prevalence of glaucoma among the patients suffering from pseudo exfoliation syndrome was 38.3% with mean IOP 17.3±3.7 mmHg. PEX is an age-related disorder and a major significant risk factor in the development of glaucoma. PEX patients should frequently get examined to prevent glaucoma development.

Conflicts of interest: The authors declare that they have no competing interests

Ethical statement: The work has been carries out after securing proper ethical permission from the Institutional Ethical Committee vide their communication No. ASCOMS/PS/IRC/ 193-195/EC/444 dated 22-05-2023.

Consent from participants: Prior to the conduct of study, the informal voluntary consent was obtained from all the participating study subjects. Further, the research was conducted in compliance with local and regional authorities on human ethics.

Authors' contributions: Dr. Arbaz Hassan conceived the concept and designed the study, collected the data and drafted the manuscript. Dr. A.S. Bali provided guidance in current study, participated in data collection and reviewed the drafted manuscript. Dr. Andleeb Hassan and Dr. Saila Farooquee conducted statistical analysis of data and helped in drafting the manuscript.

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