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Proportion of Pseudoexfoliative Glaucoma Among Glaucomatous Patients Attending Makah Hospital in Aden, Yemen

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ABSTRACT

Background: Pseudoexfoliative glaucoma is the most common type of secondary open-angle glaucoma.
Objective: To describe the proportion and clinical features of pseudoexfoliative glaucoma among glaucomatous patients
Materials and method: A retrospective chart review. The collected data were sex, age, family history, clinical features, clinical eyes examination, type of treatment and intraocular pressure outcome.
SPSS version 17 was used. Data were presented as frequencies and means. The statistical significance of differences between data was evaluated using *Fisher test.* P <0.05 was considered to indicate statistical significance.
Results: The proportion of PEXG patients among glaucoma patients was (9.1%). (Females 51.2% and males 48.8%). The mean age of the patients is 67.6±9.8 years. The patients of the age group 60-69 years old were predominant. 65.1% had bilateral PEXG.
Severe visual impairment (27.9%) found in the right eyes and (34.9%) were in the left eyes. Round regular react pupils were (60.5%) in the right eyes and (74.4%) in the left eyes, followed by relative afferent pupillary defect with (27.9%) in the right eyes and (11.6%) in the left eyes. High IOP > 21 mmHg found in (60.5%) the right eyes and (53.5%) in the left eyes. The cup/disc ratio with > 0.5 in the right eyes of the PEXG patients found in (60.1%). The means of cup/disc ratio in the right and the left eyes were 0.65 ± 0.26 and 0.67 ± 0.28 respectively (p <0.05). The medication treatment was given for (76.7%) patients and medication + surgical treatment was given for (23.3%).
Conclusion: PEXG was more frequently observed in females. The proportion of PEXG patients was (9.1%). Severe visual impairment was predominant in both eyes. A population-based study suggests to further define the prevalence and characteristics of PEXG in Aden and the surrounding governorates.

Key words: proportion, pseudoexfoliative glaucoma, Makkah hospital, Aden.

INTRODUCTION

Pseudoexfoliation is an age-related systemic disorder of the extracellular matrix that can affect several tissues and organs of the body with clinical consequences especially on the eye [1,2]. Pseudoexfoliation is associated with an increased risk of surgical complications in cataract surgery and it increases the risk of open-angle glaucoma [3,4]. It has also been stated that the glaucoma is more severe in eyes with Pseudoexfoliation than in primary open-angle glaucoma [5]. Pseudoexfoliative glaucoma (PEXG) is the most common type of secondary open-angle glaucoma [6].
Pseudoexfoliation syndrome is considered the most identifiable cause of secondary open angle glaucoma (pseudoexfoliative

glaucoma) [6], characterized by the gradual accumulation and deposition of a whitish fibrillar substance of unknown origin, most notably in intraocular anterior segment structures, such as the anterior lens capsule, iris and pupillary margin, iridocorneal angle, zonules, ciliary body and corneal endothelium [7]. Extraocular tissues, such as conjunctival goblet cells and accessory lacrimal glands, also appear to be affected by pseudoexfoliative deposition, as demonstrated in conjunctival biopsies and impression cytology studies [8,9,10]. The abnormal or reduced function of such structures may lead to alterations of the mucous layer of the tear film, resulting in dry eye syndrome and ocular surface disease [11], implying a direct impact of pseudoexfoliation syndrome on tear film stability.

Rates of PEXG vary worldwide, where PEXG was observed in up to 25% of people over 60 in certain Nordic populations [12]. Indeed, PEXG is the most common form of glaucoma observed in some countries [13].

Objective:

To describe the proportion and clinical features of pseudoexfoliative glaucoma (PEXG) among glaucomatous patients

MATERIALS AND METHOD

Nine hundred and forty six patients were presented to Makkah hospital in Aden, Yemen during the period January 2020 to December 2021, with glaucoma. A retrospective chart review was conducted for the 86 patients with PEXG. In this current study, patients with PEXG were identified and their data were collected and analyzed with respect to sex, age, family history, clinical features, clinical eyes examination type of treatment and outcome of intraocular pressure.

The patients with peak IOP above 21 mmHg were designated as high-tension cases and those 21 mmHg and under, as normal-tension cases [14]. In addition, we categorized the levels of visual acuity as follows:

a) 0.4 – 0.6 (mild visual impairment), b) 0.2 – 0.3 (moderate visual impairment) and c) 0.05 – 0.1 (severe visual impairment) [15]

SPSS Statistics software version 17 was used to perform all statistical analyses. Data are presented as mean values with the standard deviation (SD). The statistical significance of differences between data was evaluated using *Fisher test.* $P < 0.05$ was considered to indicate statistical significance.

RESULTS

The total glaucoma patients attending Makkah hospital during the period January 2020 to December 2021 were 946 patients. Out of them 86 patients with PEXG. The proportion of PEXG patients among glaucoma patients was (9.1%). For the 86 patients with PEXG disease included in the study, the females were 44 (51.2%) and the males were 42 (48.8%) with a ratio female to male 1.05:1 (Table 1 & Figure 1).

The mean age of the patients is 67.6 ± 9.8 years and their age ranged between 50 to 90 years. The mean age of male patients is 66 ± 9.0 years and the mean age of female patients is 69.2 ±10.5

Table 1: Distribution of study patients related to sex, and mean ages of males and females (n= 86)

Variables	No	%
Patients enrolled		
Males	42	48.8
Females	44	51.2
Age range (years):	50 – 90	
Mean age of patients (years):	67.6 ± 9.8	
Mean age of males (years):	66 ±9.0	
Mean age of females (years):	69.2 ±10.5	
P-value:	> 0.05	

Figure 1: Proportion of study patients

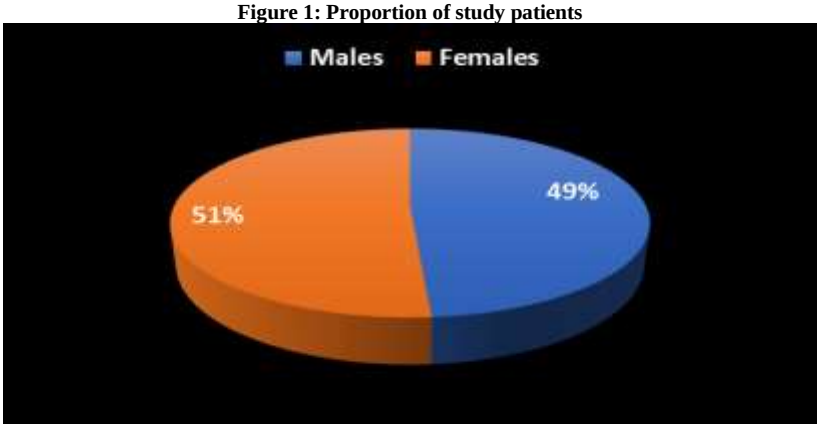


Table 2 reveals the distribution of age groups, family history and PEXG of the study patients related to sex. In female patients, the age group 50 – 59 years old represented 4 (4.7%) while in male patients they were 6 (7.0%) and the total patients of this age group were 10 (11.6%). The patients of the age group 60 – 69 years old were predominant with 34 (39.5), they were 18 (20.9%) females and 16 (18.6%) males. The patients of the age group 70 – 79 years were 24 (27.9%) and were 10 (11.6%) females and 14 (16.3%) males. Patients of the age 80 years and more were 18 (20.9%) of the study patients. The difference between values was statistically not significant ($p > 0.05$). Additionally, Table 2 shows 22 (25.6%) of the PEXG patients had family history, and they were 8 (9.3%) female patients and 14 (16.3%) male patients, ($p < 0.05$). Of the 86 PEXG patients, 56 (65.1%) had bilateral PEXG, while 30 (34.9%) patients had unilateral PEXG. Of the 86 PEXG patients (142 eyes) in the study, Table 2 & Figure 2.

Table 2: Distribution of age groups, family history and PEXG related to sex (n=86)

Variables	Sex		Total	p-value
	Females (n=44) No (%)	Males (n=42) No (%)	No (%)	
Age groups (years):				
50-59	4 (4.7)	6 (7.0)	10 (11.6)	
60-69	18 (20.9)	16 (18.6)	34 (39.5)	P > 0.05
70-79	10 (11.6)	14 (16.3)	24 (27.9)	
≥ 80	12 (14.0)	6 (7.0)	18 (20.9)	
Family history:				
No	36 (41.8)	28 (32.6)	64 (74.4)	P < 0.05
Yes	8 (9.3)	14 (16.3)	22 (25.6)	
PEXG:				
Bilateral	32 (37.2)	24 (27.9)	56 (65.1)	P > 0.05
Unilateral	12 (14.0)	18 (20.9)	30 (34.9)	

Figure 2: Types of pseudoexfoliative glaucoma related to sex

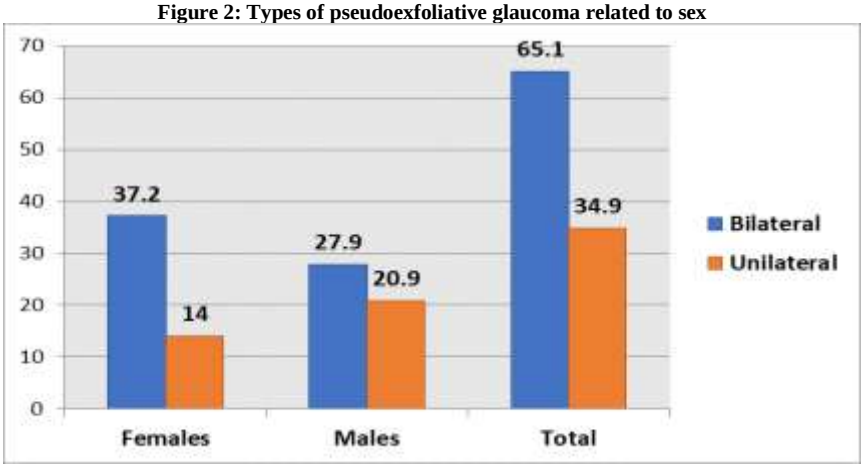


Table 3 reveals the distribution of clinical eyes examination of the study patients. Twenty-four (27.9%) of 0.05-0.1 visual acuity (VA) group found in the right eyes while 30 (34.9%) are in the left eyes.

The distribution of the VA group 0.2-0.3 are similar, 12 (13.9%) in the right side and 12 (13.9%) in the left eyes.

In addition the distribution of the 0.4-0.6 VA group between the right eyes and the left eyes are equally with 14 (16.3%) for each one. Counting finger (CF) group were 16 (18.6%) in the right eyes and 9 (10.5%) in the left eyes. Hand movement (HM) group 8 (9.3%) in the right eyes while only 3 (3.5%) in the left eyes. Light perception were 6 (7.0%) in the right side and 2 (2.3%) in the left eyes, in addition no light perception found 2 (2.3%) in the right eyes and 12 (13.9%) in the left eyes.

With regard to pupil, we found round regular react (RRR) in 52 (60.5%) in the right eyes and 64 (74.4%) in the left eyes, followed by relative afferent pupillary defect (RAPD) with 24 (27.9%) in the right eyes and 10 (11.6%) in the left eyes. Mild dilated pupil were 6 (7.0%) in the right eyes and 4 (4.7%) in the left eyes. Afferent Pupillary Defect were 2 (2.3%) in the right eyes and 6 (7.0%) in the left eyes, followed by sluggish pupil with 2 (2.3%) in the right eyes and similarly in the left eyes with 2 (2.3%).

We categories the pre-treatment IOP in two groups: normal IOP ≤ 21 mmHg and higher IOP greater than 21 mm Hg.

Normal IOP ≤ 21 mmHg were found in 34 (39.5%) patients in their right eyes. In the left side, there were 40 (46.5%) patients with normal IOP ≤ 21 mmHg. High IOP > 21 mmHg found in 52 (60.5%) the right side and 46 (53.5%) in the left side. The means of right and left pre-treatment IOP were 23.3 ± 7.4 and 23.2 ± 8.4 respectively. Comparison between the two means was statistically significant ($p < 0.05$), (Table 3).

We considered cup/disc ratio ≤ 0.5 as normal and > 0.5 abnormal. The cup/disc ration with ≤ 0.5 in the right eyes of the PEXG patients was on 30 (34.9%) patients, while the cup/disc ratio with > 0.5 in the right eyes of the PEXG patients found of 56 (60.1%). In the left eyes 32 (37.2%) of patients have cup/disc ratio ≤ 0.5 and 54 (62.8%) have cup/disc ratio > 0.5.

The means of cup/disc ratio in the right and the left eyes were 0.65 ± 0.26 and 0.67 ± 0.28 respectively, with positive relation between the means ($p < 0.05$), as shown in Table 3.

Table 3: Distribution of clinical eyes examination of the study patients (n=86)

Variables	**Side of impairment**			
	Right No (%)		**Left No (%)**	
Visual acuity groups:				
0.7 – 1.0	4	(4.7)	4	(4.7)
0.4 – 0.6 (mild visual impairment)	14	(16.3)	14	(16.3)
0.2 – 0.3 (moderate visual impairment)	12	(13.9)	12	(13.9)
0.05 – 0.1 (severe visual impairment)	24	(27.9)	30	(34.9)
Counting finger	16	(18.6)	9	(10.5)
Hand movement	8	(9.3)	3	(3.5)
Light perception	6	(7.0)	2	(2.3)
No light perception	2	(2.3)	12	(13.9)
Pupil:				
Round regular react (RRR)	52	(60.5)	64	(74.4)
Relative Afferent Pupillary Defect (RAPD)	24	(27.9)	10	(11.6)
Mild dilated	6	(7.0)	4	(4.7)
Afferent Pupillary Defect	2	(2.3)	6	(7.0)
Sluggish	2	(2.3)	2	(2.3)
Pre-treatment IOP:				
≤ 21 mmHg	34	(39.5)	40	(46.5)
> 21 mmHg	52	(60.5)	46	(53.5)
Mean of Pre-treatment IOP	23.3 ± 7.4		23.2 ± 8.4	
P-value	0.000			
Cup/Disc ratio:				
≤ 0.5	30	(34.9)	32	(37.2)
> 0.5	56	(65.1)	54	(62.8)
Mean of Cup/Disc ratio:	0.65 ± 0.26		0.67 ± 0.28	
P-value	0.000			

Table 4 and Figure 3, illustrate the distribution of anterior chamber angle (AC angle). Open angle of anterior chamber found among the Pseudoexfoliation patients with 82 (95.3%) and closed angle of anterior chamber was 4 (4.7%).

Table 4: Distribution of AC angle (n= 86)

Variables	No	%
AC angle:		
Open	82	95.3
Closed	4	4.7
Total	86	100

Anterior Chamber angle = AC angle

Figure 3: Types of Anterior Chamber angle of the study patients

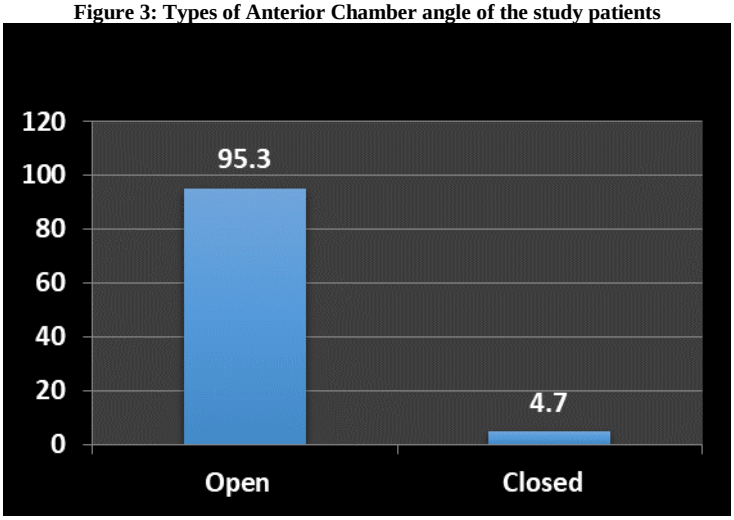


Table 5 and Figure 4 show the distribution of treatment methods applied for PEXG patients and their IOP as outcome. The medication treatment was given for 66 (76.7%) patients and medication + surgical treatment was given for 20 (23.3%) patients. In the right side the IOP ≤ 21 mmHg was found in 62 (72.2%) patients while IOP > 21 mmHg found in 12 (13.9%) patients. The range of normal IOP in the right side found 10 – 20 mmHg and the higher IOP ranged between 24 – 45 mmHg. The relationship between means is statistically significant (p = 0.000).

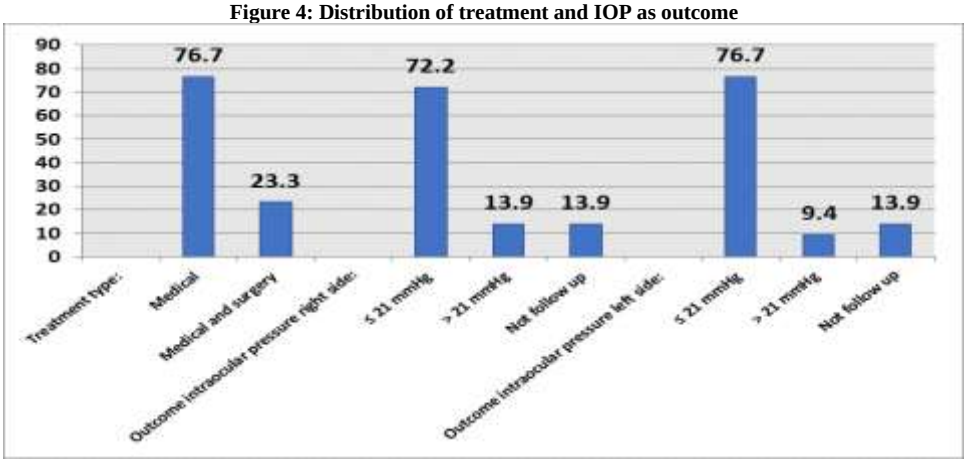
In the left side, the patients with normal IOP (≤ 21 mmHg) were 66 (76.7%) and in the higher IOP group > 21 mmHg were 8 (9.4%) patients. The relation between means was statistically significant (p = 0.000).

Out of the 86 study patients, only 74 patients attended the follow-up post treatment and the total patients who did not attending the follow up were 12 patients. The reducing IOP after treatment with medications and medications +surgery was in the right eyes 40 (54.1%) and in the left eyes was 34 (45.9%).

Table 5: Distribution of treatment methods and IOP as outcome

Variables	No	%	Range	Mean	p-value
Treatment type: No patients = 86					
Medication	66	76.7			
Medication and surgery	20	23.3			
Outcome IOP right eyes (No patients = 74					
≤ 21 mmHg	62	83.8	10-20	13.9 ±3.2	
> 21 mmHg	12	16.2	24-45	31.0 ± 8.7	0.000
Outcome IOP left side:					
≤ 21 mmHg	66	89.2	8-21	14.2 ± 3.5	0.000
> 21 mmHg	8	10.8	24-35	30.3 ± 4.3	
Reducing the IOP:					
In the right eyes	40	54.1			
In the left eyes	34	45.9			

Figure 4: Distribution of treatment and IOP as outcome



DISCUSSION

The PEXG, characterized by the presence of pseudoexfoliative material, is the most common identifiable form of secondary open-angle glaucoma worldwide. PEXG occurs as a complication of pseudoexfoliation syndrome [6]. PEXG is the most common form of open-angle worldwide with an identifiable etiology [16].

In the present study, we found the proportion of PEXG patients among glaucoma patients attending Makkah hospital in Aden, during two years was (9.1%). The prevalence of PEXG among glaucoma patients varies in different communities [17].

A study in United States reported PEXG among glaucoma patients to be 19% [18] that is higher as our finding. Other studies found less than our study finding, one from South India, reported that PEXG was found in 4.2% of glaucoma patients [19] and other study from Nigeria reported that the prevalence of PEXG among open-angle glaucoma patients was 3.6% [20].

In Western India, prevalence of PEXG increased with increasing age, reaching 30% in the population aged 60 years and older [21].

In our study, women outnumbered men only in two patients, and that mean there was no difference of PEXG related to sex. Additionally, the ratio female to male was 1.05:1. Other studies reported that there was no sex predilection [22, 23].

In our study, we found that the mean age of the patients with PEXG was 67.6 ± 9.8 years. The occurrence of PEXG increased with age and was highest among patients aged 60 and 69 years. About 88.4% of all PEXG patients were ≥ 60 years old. This finding is comparable to other published studies [22, 24-26].

Our present study revealed that (25.6%) of the PEXG patients had family history, and they were (9.3%) female patients and 14 (16.3%) male patients, ($p < 0.05$). Gur-Gungor et al [27] from Turkey that 103 (15.4%) patients had a positive family history.

In our current study, we found of the 86 PEXG patients, (65.1%) had bilateral PEXG, while (34.9%) patients had unilateral PEX. That mean the bilateral PEXG was predominant. Gur-Gungor et al [27] reported similar to our finding that (77.1%) of their study patients with PEXG had bilateral disease and (22.9%) had unilateral disease.

Onochie et al [17] reported that out of the 25 patients with PEXG, 19 (76%) were found to have bilateral PEXG and the remaining 6 (24%) had unilateral PEXG, four in the right eye and two in the left eye.

In our study we found the pupils round regular react (RRR) in 52 (60.5%) in the right eyes and 64 (74.4%) in the left eyes, followed by relative afferent pupillary defect (RAPD) with 24 (27.9%) in the right eyes and 10 (11.6%) in the left eyes. Mild dilated pupil were 6 (7.0%) in the right eyes

and 4 (4.7%) in the left eyes. Afferent Pupillary Defect were 2 (2.3%) in the right eyes and 6 (7.0%) in the left eyes, followed by sluggish pupil with 2 (2.3%) in the right eyes and similarly in the left eyes with 2 (2.3%).

In the present study, normal IOP ≤ 21 mmHg were found in 34 (39.5%) patients in their right eyes. In the left side, there were 40 (46.5%) patients with normal IOP ≤ 21 mmHg. High IOP > 21 mmHg found in 52 (60.5%) the right side and 46 (53.5%) in the left side. The means of right and left pre-treatment IOP were 23.3 ± 7.4 and 23.2 ± 8.4 respectively. Comparison between the two means was statistically significant ($p < 0.05$).

Musch et al [28] reported that intraocular pressure in PEXG patients is known to be higher than in primary open-angle glaucoma patients and it is about 31.9 mmHg. This finding is higher of our result, which was 23.3 ± 7.4 mmHg in the right eyes and 23.2 ± 8.4 mmHg in the left eyes.

Bharadwaj et al [29] reported in their study that, the average IOP in PEXG patients was 29.31 ± 8.67 mmHg.

We considered vertical cup/disc ratio ≤ 0.5 as normal and > 0.5 abnormal. The Cup/Disc ratio with ≤0.5 in the right eyes of the PEXG patients was on 30 (34.9%) patients, while the Cup/Disc ratio with > 0.5 in the right eyes of the PEXG patients found of 56 (60.1%). In the left eyes 32 (37.2%) of patients have Cup/Disc ratio ≤ 0.5 and 54 (62.8%) have Cup/Disc ratio > 0.5. The means of cup/disc ratio in the right and the left eyes were 0.65 ± 0.26 and 0.67 ± 0.28 respectively, with positive relation between the means ($p < 0.05$). the mean of cup/disc ratio was 0.66.

Bharadwaj et al [29] from India, reported higher results to our findings, they found the cup/disc ratio of PEXG patients, was 0.77 ± 0.20.

In the current study, we found open angle of anterior chamber in the pseudoexfoliation patients (95.3%) and closed angle of anterior chamber was (4.7%). In published study, (2.5%) eyes had closed angles in PEXG patients, (12.82%) eyes had a narrow angle and, (84.61%) eyes had open angles [29].

Our study illustrated the distribution of treatment methods which applied for PEXG patients and their IOP as outcome. The medication treatment was given for (76.7%) patients and medication + surgical treatment was given for (23.3%) patients.

In the current study, we found in the right eyes the IOP ≤ 21 mmHg was in (72.2%) patients while IOP > 21 mmHg was in (13.9%) patients. The range of normal IOP in the right side found 10 – 20 mmHg and the higher IOP ranged between 24 – 45 mmHg. The relationship between the means is statistically significant ($p = 0.000$).

In the left side, the patients with normal IOP (≤ 21 mmHg) were (76.7%) and in the higher IOP group, > 21 mmHg were (9.4%) patients. The relation between means was statistically significant ($p = 0.043$).

PEXG is a more difficult glaucoma to treat than primary open angle glaucoma and has a higher incidence of progression. Pseudoexfoliation is also more likely to be recalcitrant to medical management and require surgical treatment. In one study, the proportion of Pseudoexfoliation patients undergoing trabeculectomy was as high as 87.8% [30].

Regardless of its aggressive and often refractory course, medical or laser treatment is usually recommended as first line therapy [31]. Compared with primary open-angle glaucoma (POAG), achieving a sufficiently low 24-hour target IOP with medical therapy is more difficult in PEXG [32]. Optimal evaluation of the efficacy of medication is ideally based on 24-hour IOP monitoring [33].

In the last decade, the role of fixed combinations in the treatment of PEXG has considerably increased [33]. PEXG surgery is typically considered when medical or laser therapy has failed to lower IOP to the desired target level; when disease progression is documented or anticipated despite maximal tolerated medical and laser therapy; when there is intolerance to

medical therapy; and in cases of inadequate adherence [34].

CONCLUSION

Pseudoexfoliative glaucoma was more frequently observed in females with older age, 60 years and older. The proportion of PEXG patients among glaucoma patients was (9.1%). Most of the cases in the present study had bilateral involvement of PEXG. Severe visual impairment found in both eyes followed by mild visual impairment than moderate visual impairment. A population-based study suggests to further define the prevalence and characteristics of PEXG in Aden and the surrounding governorates.

Declaration by Authors

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