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Clinical Characteristics and Managements of Primary Open-Angle Glaucoma Patients at National Eye Center, Cicendo Eye Hospital, Bandung, Indonesia

Karakteristik Klinis dan Tatalaksana Pasien Glaukoma Sudut Terbuka Primer di Pusat Mata Nasional, Rumah Sakit Mata Cicendo, Bandung, Indonesia

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Abstract

Glaucoma is the largest cause of permanent blindness globally. Primary open-angle glaucoma (POAG) is one of chronic glaucoma and is asymptomatic in the early stage. This study was performed to identify the clinical characteristics and management of POAG patients at the Cicendo Eye Hospital, Bandung, Indonesia. This retrospective, descriptive study was conducted on medical records of POAG patients in Cicendo Eye Hospital in January-December 2020 using whole sampling method. Sociodemographic, clinical characteristics, and management data were collected. From 147 subjects obtained, the largest age group of POAG patients was 60-69 years old (30.6%), with most of the patients being male (68.0%). Most of the patients experienced blindness (37.6%) and had cup-to-disc ratio (CDR) 0.9-1.0 (36.8%). The mean of pre-treatment IOP was 29.1 ± 13.1 mmHg, and the mean of post-treatment was 19.3 ± 7.7 mmHg. The mean of anti-glaucoma medication in the first and the last control were 1.93 ± 0.59 and 1.48 ± 0.70 , respectively. The most common treatments were medication only (69.8%), with combined surgery as the most performed surgery. In conclusion, most POAG patients were 60 years old or older and male, with most eyes being blind. The POAG treatments were mostly anti-glaucoma medication only to lower IOP as the goals of the treatment.

Keywords: *characteristic; glaucoma medication; glaucoma surgery; management; primary open-angle glaucoma*

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Abstrak

Glaukoma adalah penyebab kebutaan permanen terbanyak di dunia. Glaukoma sudut terbuka primer (GSTaP) merupakan salah satu glaukoma kronik yang bersifat asimtomatik pada tahap awal. Penelitian ini bertujuan untuk mengidentifikasi karakteristik klinis dan tatalaksana pasien GSTaP di Pusat Mata Nasional, Rumah Sakit Mata Cicendo, Bandung, Indonesia. Penelitian ini adalah penelitian deskriptif retrospektif yang dilakukan menggunakan rekam medis pasien GSTaP di Rumah Sakit Mata Cicendo periode Januari-Desember 2020 dengan metode total sampling. Hasil penelitian menunjukkan dari 147 pasien, usia terbanyak berada pada kelompok usia 60-69 tahun (30,6%) dengan mayoritas pasien berjenis kelamin laki-laki (68,0%). Mayoritas mata mengalami kebutaan dan memiliki *cup-to-disc ratio* (CDR) sebesar 0,9-1,0 (36,8%). Rerata tekanan intraokular sebelum dan sesudah tatalaksana berturut-turut adalah 29,1±13,1 dan 19,3±7,7 mmHg. Rerata jumlah medikasi pada kunjungan pertama dan terakhir berturut-turut adalah 1,93±0,59 dan 1,48±0,70. Tatalaksana terbanyak adalah medikasi saja (69,8%) dengan jenis operasi yang paling banyak dilakukan adalah operasi kombinasi. Simpulan penelitian ini adalah mayoritas pasien berusia 60 tahun atau lebih dengan jenis kelamin laki-laki dan mayoritas perawatan diberikan tatalaksana medikasi saja.

Kata kunci: karakteristik; medikasi glaukoma; operasi glaukoma; tatalaksana; glaukoma sudut terbuka primer

Introduction

Glaucoma is the second leading cause of blindness after cataracts and the largest cause of permanent blindness globally.^{1,2} Data from the population-based study show that the number of glaucoma patients over 40 years old is estimated to increase continuously by 76 million and 111.8 million people in 2020 and 2040, respectively.² The highest incidence rate of glaucoma is in Asia. Sixty percent (39 million) of all glaucoma cases in the world come from this continent.³ According to the Rapid Assessment of Avoidable Blindness (RAAB) 2014-2016, glaucoma is the third leading cause of blindness in Indonesia after cataracts and posterior segment eye disease.⁴

Glaucoma is a group of optic neuropathy diseases with progressive degeneration and functional damage of optic nerve, retinal ganglion cell death, and can be accompanied by visual field defects.⁵ Primary open-angle glaucoma (POAG) is a type of chronic glaucoma and is the most common type of glaucoma in the world, including in Asia.^{2,3} Southeast Asia is the highest prevalence of POAG (2.53%) in Asia with 4.78 million cases.³ POAG is asymptomatic in its early stages and will continue to progress slowly until visual damage symptoms appear. The late presentation can cause late diagnosis where the patient's visual field is impaired or even blind.⁵ The only proven treatment strategy for glaucoma patients currently relies on reducing intraocular pressure (IOP) either with IOP-lowering medication or IOP-lowering surgery. It is the only method of preventing glaucoma progression and further vision loss.⁶ Because of all the above explanations, POAG patients need more attention.

The latest study regarding clinical characteristics and management of POAG patients in

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Bandung, West Java is unavailable. The distribution pattern of sociodemographics, clinical characteristics, and management of glaucoma patients also prompted this study. The study aimed to identify the clinical characteristics and management of POAG patients at the National Eye Center, Cicendo Eye Hospital, Bandung, Indonesia in 2020. This hospital was chosen as the research location because this hospital is a national referral center in eye care covering various cases from many branches of ophthalmology, including glaucoma.

Methods

This retrospective, descriptive study was conducted on electronic and manual written medical records of POAG patients at Cicendo Eye Hospital in 2020. The data was collected from September until October 2021 after obtaining permission from the Medical Research Ethics Committee Universitas Padjadjaran number 547/UN6.KEP/EC/2021.

The inclusion criteria were the medical record of new patients with POAG diagnosis in the outpatient clinics of Cicendo Eye Hospital from January until December 2020. The medical records with incomplete data were excluded. Whole sampling was chosen for the sampling method in this study.

Patients with POAG are patients aged 40 years or older with IOP above 21 mmHg, have glaucomatous optic neuropathy on fundoscopic examination, the open-angle anterior chamber on gonioscopy examination, and no secondary etiology. The data taken from medical records included sociodemographic (age, sex, education level, occupation, location of residence), clinical characteristics history of hypertension and diabetes mellitus, family history of glaucoma, cataract status, presenting visual acuity, pre-treatment and post-treatment intraocular pressure (IOP), and cup-to-disc ratio (CDR)), and management (number of medication and surgery method).

Age in this study was the age of the patients when they were diagnosed with POAG. Occupation consisted of farming, housewife, entrepreneur, trader, employee, pensionary, other, and not registered. Employees consisted of civil servants, private employees, laborers, and BUMN employees. The location of residence was categorized into West Java and outside West Java. West Java was broken down into Bogor Region, Purwakarta Region, Cirebon Region, East Priangan Region, and West Priangan Region. Pre-treatment IOP was the IOP when patients were diagnosed with POAG. In contrast, post-treatment IOP was the IOP of the patients at the last visit who carried out more than one visit. Treatment was all management received by the patients either medication or surgery during treatment.

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The collected data were analyzed by univariate statistical to describe frequency, percentage, median, and mean values of the data. The results are displayed in tables and narrative form.

Results

Out of 150 medical records with POAG diagnosis in 2020, 147 medical records were met the inclusion criteria. The remainder, three medical records, were excluded due to incomplete medical record data. Out of 147 medical records, 274 eyes were diagnosed with POAG and included in this study.

Table 1 shows sociodemographic characteristic data. The patient's age ranged from 40 to 85 years, with most POAG occurring among 60-69 years old group (30.6%). Most patients were male (68.0%) and elementary school graduates and below (29.9%). Most patients worked as a housewife (21.8%). Another category of occupation consisted of teacher, lecture, nurse, and police. Half of the patients (51.0%) came from West Priangan Region, more precisely from Bandung City (17.0%). Other areas outside West Java, either inside Java Island or other islands, only occupy a small proportion of residence location so that they put together in the outside West Java group. The group contained eight areas: two Jakarta, three Central Java, one Yogyakarta, one North Sumatra, one West Sumatra, one Jambi, one Bengkulu, and one Bangka Belitung Islands.

Table 2 shows diseases and family history data. Nearly half of patients (46.3%) had hypertension and over one-tenth (13.6%) had diabetes history. In contrast, most glaucoma family history (78.9%) were not registered on medical records. Furthermore, of 147 patients, 127 patients (86.4%) had bilateral POAG, and the rest were unilateral (13.6%). Therefore, the number of eyes in this study was 274 eyes. Most eyes in this study had cataract (73.4%).

Tables 3 and 4 showed clinical characteristic data. Blindness (37.6%) and CDR in the range of 0.9-1.0 (36.8%) were the highest among patient's eyes. The disc images of 46 eyes (16.8%) have poor quality because of refractive media opacity and, hence, its CDR cannot be assessed. Anti-glaucoma medication only (69.8%), either topical or systemic, was the highest percentage of treatment. Different from previous, data analysis for data in table 4 only involved 216 eyes from 113 patients who had more than one visit. The remainder, 34 patients (58 eyes), had only one visit.

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Table 5 and 6 showed IOP and the number of medications in the first and the last visit. This data analysis also only involved 216 eyes. All treatments decreased IOP and medication number at the last visit, except for cataract extraction. The greatest decrease in IOP occurred in treatment with trabeculectomy followed by GDD implant and combined surgery, which was reduced by 23.4 ± 15.7 (50.5%), 18.5 ± 17.7 (49.7%), and 12.1 ± 13.7 (30.9%), respectively. On the other hand, the greatest decrease in the number of medications occurred in the treatment with GDD implant followed by trabeculectomy and combined surgery, which was reduced by 1.50 ± 0.71 (75.0%), 1.13 ± 0.96 (47.3%), and 0.93 ± 0.85 (41.9%), respectively.

Table 1 Sociodemographic Characteristic of POAG Patients at Cicendo Eye Hospital in 2020

Variables	Frequency	%
Age group (n=147)		
• 40-49	24	16.3%
• 50-59	37	25.2%
• 60-69	45	30.6%
• 70-79	31	21.1%
• ≥ 80	10	6.8%
Sex (n=147)		
• Male	100	68.0%
• Female	47	32.0%
Educational Level (n=147)		
• Elementary school graduate or below	44	29.9%
• Middle school graduate	18	12.2%
• High school graduate	43	29.3%
• College graduate	15	10.2%
• Not registered	27	18.4%
Occupation (n=147)		
• Farming	18	12.2%
• Housewife	32	21.8%
• Entrepreneur	3	2.0%
• Trader	29	19.7%
• Employee	29	19.7%
• Retirees	18	12.2%
• Other	4	2.7%
• Not registered	14	9.5%
Location of Residence (n=147)		
• Bogor Region	9	6.1%
• Purwakarta Region	19	12.9%
• Cirebon Region	14	9.5%
• East Priangan Region	19	12.9%
• West Priangan Region	75	51.0%
• Outside West Java	11	7.5%

Bogor Region = Bogor, Depok, Sukabumi, Cianjur; Purwakarta Region = Purwakarta, Subang, Bekasi, Karawang; Cirebon Region = Cirebon, Indramayu, Majalengka, Kuningan; East Priangan Region = Ciamis, Banjar, Tasikmalaya, Sumedang, Pangandaran; West Priangan Region = Bandung City, Bandung District, West Bandung, Cimahi, Garut

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Table 2 Diseases and Family History of POAG Patients at Cicendo Eye Hospital in 2020

Variables	Frequency	%
History of Hypertension (n=147)		
• Yes	68	46.3%
• No	75	51.0%
• Not registered	4	2.7%
History of Diabetes (n=147)		
• Yes	20	13.6%
• No	99	67.4%
• Not registered	28	29.0%
Family History of Glaucoma (n=147)		
• Yes	3	2.0%
• No	28	19.1%
• Not registered	116	78.9%
Cataract Status (n = 274)		
• Yes	201	73.4%
• No	73	26.6%

Table 3 Clinical Characteristics and Managements of POAG Patients at Cicendo Eye Hospital in 2020

Variables	Frequency	%
Presenting Visual Acuity (n=274)		
• Normal (>0.5)	80	29.2%
• Mild visual impairment (<0.5–0.33)	19	6.9%
• Moderate visual impairment (<0.33-0.1)	57	20.8%
• Severe visual impairment (<0.1-0.05)	15	5.5%
• Blindness (<0.05)	103	37.6%
Cup-Disc Ratio (n=274)		
• 0,1-0,2	0	0.0%
• 0,3-0,4	12	4.4%
• 0,5-0,6	52	19.0%
• 0,7-0,8	63	23.0%
• 0,9-1,0	101	36.8%
• Hard to assess	46	16.8%
Treatment (n=274)		
• Medication only	194	70.8%
• Trabeculectomy	31	11.3%
• Cataract extraction	5	1.8%
• Glaucoma Drainage Device (GDD) implant	2	0.7%
• Combined surgery	41	15.0%
• GDD implant and cataract extraction	0	0.0%
• Transscleral Cyclophotocoagulation (TCP)	1	0.4%
Medication Number in First Visit (n=274)		
• No medication	0	0.0%
• One medication	58	21.2%
• Two medications	178	64.9%
• Three medications	38	13.9%
Medication Number in Last Visit (n=274)		
• No medication	19	8.8%
• One medication	81	37.5%
• Two medications	109	50.5%
• Three medications	7	3.2%

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Discussion

Sociodemographic data described characteristics of the disease in population. It showed that most POAG patients in this study were 60 years old or older (58.5%). This finding is appropriate for hospital-based studies in Indonesia which showed that more than half of POAG patients were found at over 60 years.⁷ According to the systematic review study, the prevalence of POAG had been shown to increase with age.² Older age is related to the cumulative effect of some factors that cause higher IOP and also higher vulnerability of optic nerve head damage.^{8,9} Furthermore, more than half of the patients were male (68.0%) and it is consistent with another previous study, including in Indonesia, which found that most POAG patients were male.^{7,10,11}

Table 4 Intraocular Pressure and Anti Glaucoma Medication of POAG Patients at Cicendo Eye Hospital in 2020

Variables	Mean ± SD (mmHg)	Min-Max (mmHg)
Pre-treatment IOP (n = 216)	29.2 ± 13.4	6.3-74
Post-treatment IOP (n = 216)	19.3 ± 7.7	6-50
First visit medication number (n = 216)	1.94 ± 0.58	1-3
Last visit medication number (n = 216)	1.48 ± 0.70	0-3

Table 5 Intraocular Pressure Before and After Treatment of POAG Patient at Cicendo Eye Hospital in 2020

Treatments	Pre-Treatment IOP (mmHg)		Post-Treatment IOP (mmHg)	
	Mean ± SD	Min-Max	Mean ± SD	Min-Max
Medication only (n=136)	26.9 ± 11.8	8-74	20.4 ± 8.1	8-50
Trabeculectomy (n=31)	40.0 ± 15.7	12-70	16.5 ± 6.1	6-35
Cataract extraction (n=5)	19.0 ± 5.1	11-24	20.2 ± 1.5	18-22
GDD implant (n=2)	34.5 ± 6.4	30-39	16.0 ± 11.3	8-24
Combined surgery (n=41)	29.2 ± 12.3	12-60	17.2 ± 5.5	6-35
TCP (n=1)	60	-	42	-

GDD = Glaucoma Drainage Device, TCP = Transscleral Cyclophotocoagulation

Table 6 Medication Number in The First and Last Visit of POAG Patient at Cicendo Eye Hospital in 2020

Treatments	No. of Medication in The First Visit		No. of Medication in The Last Visit	
	Mean ± SD	Min-Max	Mean ± SD	Min-Max
Medication only (n=136)	1.85 ± 0.57	1-3	1.67 ± 0.61	0-3
Trabeculectomy (n=31)	2.32 ± 0.54	1-3	1.19 ± 0.83	0-2
Cataract extraction (n=5)	1.20 ± 0.45	1-2	1.40 ± 0.55	1-2
GDD implant (n=2)	2.00 ± 0.00	2-2	0.50 ± 0.71	0-1
Combined surgery (n=41)	2.05 ± 0.55	1-3	1.12 ± 0.68	0-2
TCP (n=1)	2.00	-	2.00	-

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The systematic review study showed that males were 36% more likely to have POAG than females.² There are no exact causes of this occurrence. Nevertheless, several theories about eye anatomical and hormonal differences between males and females can explain sex differences in POAG development. Men have a longer axial length which is associated with progressive visual field deterioration related to IOP.¹² Furthermore, estrogen-related hemodynamic factors suggest this hormone influences aqueous humor production and its drainage support in women.¹¹

Nearly half of POAG patients in this study had a hypertension history (46.3%). This finding is similar to a previous study conducted by Ribeiro et al. in Brazil which showed that almost half of the POAG patients (49.2%) had hypertension.¹³ The study conducted in Africa found that hypertension was significantly associated with POAG.¹¹ The association between POAG and systemic hypertension is complex. Hypertension in older patient leads to the alteration of blood vessels and subsequently reduce ocular perfusion.¹⁴ In addition, the increase in blood pressure is associated with the rise in average IOP, one of the risk factors of POAG development and progression.¹⁵

In this study, 13.6% of POAG patients had a diabetes history. This is similar to a previous study conducted by Ribeiro et al. in Brazil which showed that 17.9% of POAG patients had diabetes.¹³ The findings from the systematic review study show the significant positive relation between DM and an increased risk of POAG.^{16,17} The mechanism linking diabetes to POAG was still unclear. Nevertheless, several hypotheses have been explained that diabetes would lead to vascular impairment which reduces blood flow to the retina and optic nerve.¹⁶ Furthermore, hyperglycemia of aqueous humor in the eye with diabetes would stimulate the synthesis and accumulation of fibronectin in the trabecular meshwork and, hence, could impair the outflow of aqueous humor which result in POAG.¹⁷

Only three POAG patients (2%) had a family history of glaucoma in this study. Family history was a strong risk factor for the presence and severity of POAG in many studies.¹⁸ The study conducted by Abdull et al. in Nigeria found that 22% of POAG patients had a family history of glaucoma.¹⁹ Nonetheless, family history in this study may be underestimated, shown by the high proportion of no family history records (78.9%). This may occur due to a lack of glaucoma knowledge or awareness among the patients and their family members.

More than one-third of patients' visual acuity in this study was less than 0.05 or blindness (37.6%). This result is in line with a study conducted by Okosa et al. in Nigeria which showed that most of the eyes in POAG patients were blind (35.6%).²⁰ POAG is asymptomatic in its early stages. The high blindness rate in glaucoma patients may be happened because of the late presentation of POAG which can be accompanied by the ignorance of the illness. Therefore, late

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diagnosis and treatment can occur. Besides, visual acuity findings in this study may be influenced by the high number of coexisting cataracts which affects the patient's visual acuity. Almost three-quarters (73.4%) of eyes had cataracts. As glaucoma, cataract is an age-related condition and prevalent in the aging population. Therefore, glaucoma and cataract are frequently coexisting ocular conditions in the elderly population.²¹ The study conducted by Talaat et al. in Saudi Arabia found that the most prevalent ocular comorbidity in glaucoma was cataracts (49.1%).²² High number of blindness and coexist cataracts among POAG patients in this study may be influenced by the relatively high number of referral patients to Cicendo Eye Hospital. Unfortunately, this study did not record the patient's referral status.

More than one-third of eyes were in the 0.9-1.0 group (36.8%). This finding is similar to the study conducted by Ilahi et al. in Padang, Indonesia, which showed that most patients' CDR was 0.9-1.0.⁷ Enlargement of CDR in glaucomatous eyes occurs due to degeneration of retinal ganglion cell and their axon as a glaucoma progression. This condition results in structural changes of the optic disc and visual field impairment.⁵ Visual acuity and CDR findings may be related in this study which most findings in both variables were <0.05 and 0.9-1.0, respectively. The study conducted by Duke et al. in Nigeria found that CDR exceeding 0.8 was more likely to be associated with visual acuity of 0.1 or worse compared to CDR less than or equal to 0.7.²³ Besides, visual acuity higher than 0.05 or CDR smaller than 0.6 may be diagnosed POAG according to other examinations such as visual field test by Humphrey field analyzer or cross-sectional retina imaging by ocular coherence tomography (OCT). Nevertheless, this study did not obtain the information due to limited medical records data.

Pre-treatment IOP of all studied eyes showed a high mean of 29.1 ± 13.1 mmHg. Subsequently, post-treatment IOP showed a normal mean of 19.3 ± 7.7 mmHg. Gyasi et al. in Ghana also found the high pre-treatment IOP mean in POAG patients, with significantly decreased IOP from 31.9 ± 8.9 mmHg to 21.3 ± 6.6 mmHg at the sixth month of treatment.²⁴ The increased IOP is preceded by increased resistance of the aqueous humor outflow in the trabecular meshwork. This trabecular meshwork has abnormal changes in collagen structure, intertrabecular space, juxtacanalicular connective tissue, and endothelial function.⁵ Higher IOP is one of the risk factors of POAG development and progression, which induces greater retinal dysfunction related to mechanical axonal damage and retinal ganglion cell death.²⁵ Indeed, all treatments received by patients with POAG are to lower the high IOP toward a target IOP. Lowering IOP is the only clinically proven management for neuroprotection in POAG and for slowing down the rate of its progression.⁶

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Most managements given to the patients were medication only (69.8%). Principally, initial treatment of glaucoma begins with IOP-lowering medication, except in cases with very high initial IOP requiring immediate surgery. Then if medication is not sufficient to control glaucoma, surgery can be considered to be performed.^{5,10} Indeed, all patients in this study were managed initially with medical treatment.

Most of the patients in this study received two anti-glaucoma medications at the first and last visits with various durations of treatment, either in patients who had received surgery or not. Gyasi et al. in Ghana also found that most patients received two medications in the first visit as well as the sixth months and twelfth months of treatment.²⁴ In this study, the maximum of medication in the first and the last visit declined from 1 – 3 to 0 - 3. This result is in line with the study conducted by Alzuhairy et al. in Saudi Arabia that found the decreasing mean of medication number at a certain time after treatment.¹⁰ In general, standard glaucoma management substantially declines the number of glaucoma medications if the target IOP has been achieved and vice versa.¹⁰

Among patients who received surgery, combined surgery (14.7%), or cataract extraction with trabeculectomy, is the most frequently performed surgery. Combined surgery is a surgical option for POAG patients with visually significant cataracts which cataract extraction alone is not sufficient to achieve or maintain controlled IOP and also prevents the post-operative IOP spike that can occur in cataract extraction alone.²¹ This finding is different from another study which showed that the most performed surgery in POAG patients was trabeculectomy.²² Trabeculectomy is the most common surgical method performed to reduce IOP significantly.^{5,25} This difference may be influenced by cataract status coexisting with the majority of POAG in this study.

When detailing each treatment, trabeculectomy alone is the largest pre-treatment IOP (mean 40 ± 15.7 mmHg) and greatest IOP reduction (50.5%). Trabeculectomy is more beneficial for patients with uncontrolled glaucoma because it achieve a greater IOP reduction and give a long-term controlled postoperative IOP below 20 mmHg either with or without additional medication.^{21,26,27} The study conducted by Jung et al. in Mexico showed that both baseline and reduction of IOP in trabeculectomy alone (baseline mean 17.5 ± 5.2 mmHg, reduction 24.6%) were higher than baseline and reduction of IOP in combined surgery (baseline mean 15.4 ± 4.5 mmHg, reduction 20.8%) and cataract extraction alone (baseline mean 13.9 ± 2.9 mmHg, reduction 6.5%).²⁸ The Tube Versus Trabeculectomy (TVT) Study also showed that trabeculectomy had the higher IOP baseline and reduction (baseline mean 25.6 ± 5.3 mmHg, reduction 49.5%) than GDD implant (baseline mean 25.1 ± 5.3 mmHg, reduction 41.4%).²⁹

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Moreover, the highest medication number in the first visit is trabeculectomy (mean 2.3 ± 0.5) followed by GDD implant (mean 2.0 ± 0.0) and combined surgery (mean 2.0 ± 0.5), whereas the highest reduction is GDD implant (reduction mean 1.50 ± 0.71 , 75.5%) followed by trabeculectomy (reduction mean 1.13 ± 0.96 , 47.3%). The TVT study showed that the reduction of medication number of GDD (reduction mean 1.8 ± 1.8) was higher than trabeculectomy (reduction mean 1.7 ± 2.0). However, different from this study, the mean of medication number baseline of GDD implant in the TVT study (mean 3.2 ± 1.1) was higher than trabeculectomy (mean 3.0 ± 1.2).²⁹ The GDD implant finding in this study may be influenced by the small number of eyes receiving this surgery. Moreover, the study conducted by Chen et al. in Taiwan showed that trabeculectomy had the higher medication number baseline and reduction (baseline mean 3.04 ± 1.43 , reduction 1.88 ± 1.51) than combined surgery (baseline mean 2.83 ± 1.48 , reduction 1.62 ± 1.35) and cataract extraction alone (baseline mean 1.22 ± 1.30 , reduction 0.82 ± 1.02).³⁰

Interestingly, unlike other POAG treatments in this study, cataract extraction alone at the last visit had higher IOP and medications than the first visit. Of the five eyes that underwent cataract extraction alone, there were two eyes whose last visit was recorded at the second and thirteenth day after cataract extraction and IOP of both is higher than the IOP in the first visit. For POAG patients, cataract extraction has a risk of increasing IOP for the first 24 hours post-surgery and it will decrease gradually.²¹ The study conducted by Majstruk et al. showed that IOP after cataract extraction increased from baseline at day one (increase mean 5.8 ± 8 mmHg) and day seven (increase mean 1.6 ± 5 mmHg). Afterward, IOP at one month (reduction mean 0.15 ± 4 mmHg) and six months decreased compared to the pre-surgery IOP (reduction mean 1.44 ± 2.8 mmHg).³¹ The study also showed that the number of medications slightly increased after cataract extraction with no statistically significant.³¹

This study has several limitations. First, this study did not record data related to the visual field defect and optic disc imaging, which both are better to describe the glaucomatous eyes characteristics. Second, this study did not assess the duration of treatment as well as its compliance. This information may affect the post-treatment IOP and the last visit medication number which both data in this study were recorded in different duration. Further studies are suggested to have visual field and optic disc assessment as well as treatment duration and compliance.

Conclusion

In conclusion, most POAG patients were 60 years old or older and male, with most of the eyes were blind and had CDR 0.9-1.0. The mean of IOP and medication number decreased at the

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last visit compared with the first visit. Lower IOP in the last visit is following the goals of treatment. The greatest decrease in IOP occurred in treatment with trabeculectomy followed by GDD implant and combined surgery. The treatments for POAG were mostly anti-glaucoma medication alone, with combined surgery as the most performed surgery. The greatest decrease in the number use of medications occurred in the treatment with GDD implant followed by trabeculectomy and combined surgery. Prospective cohort studies on clinical characteristics and management of POAG are needed to obtain POAG characteristics related to disease progression as a complement to this research.

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