

ORIGINAL ARTICLE

SURGICAL THERAPY FOR PRIMARY GLAUCOMA IN DR. KARIADI GENERAL HOSPITAL SEMARANG DURING JANUARY 2020 TO DECEMBER 2022

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ABSTRACT

Introduction and Objective: Glaucoma can be treated with medicamentose, non invasive surgery, and invasive surgery. This study aims to determine the frequency and type of invasive surgery for primary glaucoma in Dr. Kariadi General Hospital during January 2020 to December 2022.

Methods: This was a descriptive research using secondary data obtained from electronic medical records, consist of gender, age, diagnosis, and type of surgery. The sample were taken with purposive sampling wherein patients meeting the predetermined inclusion and exclusion criteria were chosen to be part of the study.

Result: There were total of 395 eyes (395 patients) with primary glaucoma who underwent surgery, consisted of 33% patients with open angle glaucoma (POAG) and 67% patients with angle closure glaucoma (PACG). Most common surgical therapy for POAG was trabeculectomy (37%), followed by combination of trabeculectomy and cataract extraction with intra ocular lens insertion (phacotrabeculectomy) (32%), cataract extraction with intra ocular lens insertion (16%), cyclocryotherapy (10%), implantation of glaucoma drainage device (4%), and goniosynechialysis (1%). For PACG, most often chosen procedure was combination of trabeculectomy and cataract extraction with intra ocular lens insertion (phacotrabeculectomy) (61%), cataract extraction with intra ocular lens insertion (13%), cyclocryotherapy (12%), trabeculectomy (11%), combination of cataract extraction with intra ocular lens insertion and goniosynechialysis (2%), and implantation of glaucoma drainage device (1%).

Conclusion: The most common type of surgery for open angle glaucoma was trabeculectomy and for angle closure glaucoma was combination of trabeculectomy and cataract extraction with intra ocular lens insertion (phacotrabeculectomy)

Keywords: Primary Glaucoma, Surgery Therapy, Trabeculectomy, Cataract Extraction, Intra Ocular Lens Insertion, Phacotrabeculectomy, Cyclocryotherapy, Glaucoma Drainage Device, Goniosynechialysis.

INTRODUCTION

Glaucoma is a progressive optic neuropathy characterized by the presence of optic disc cupping and characteristic visual field loss, and intraocular pressure (IOP) is a major risk factor.¹ In glaucoma, signs of visual weakening will manifest, characterized by compromised vision function accompanied by visual field defects. Additionally, anatomical alterations will be observed in the optic nerve, presenting as excavation and degeneration of the optic nerve papillae. These changes can end in irreversible blindness. As of 2020, approximately 76 million

individuals were projected to receive a glaucoma diagnosis, with an anticipated global increase to 111.8 million by the year 2040.²

Primary glaucoma is glaucoma that occurs without any underlying disease or disorder. Based on the structure of the angle, it is classified into 2 types, primary open-angle glaucoma and primary angle-closure glaucoma.

Primary open-angle glaucoma (POAG) may manifest with or without elevated intraocular pressure (IOP). In cases of primary open-angle glaucoma, elevated IOP can arise from structural changes that occur mechanically or due to ischaemic process. Subsequently, these changes can lead to impairment of the optic nerve papillae. Conversely, POAG without elevated IOP can be caused from diminished ocular perfusion pressure, autoimmune nerve damage, reduced neurotrophic factors in nerves, failure of cellular repair mechanisms, and anomalies in autoregulation within retinal or choroidal blood vessels. Primary open-angle glaucoma primarily affects individuals aged 60 and above, black skin, a familial history of glaucoma, myopia, and individuals with vascular disorders such as hypertension and diabetes mellitus.^{3,4}

Primary angle-closure glaucoma (PACG) occurs due to the obstruction of aqueous humor flow between the posterior and anterior chambers. Risk factors includes shallow anterior chamber, a narrow iridocorneal angle, and advancing age. This condition primarily affects individuals aged over 40 and exhibits higher prevalence among Asian, African, and Inuit populations. Furthermore, its incidence rate is greater in women compared to men, particularly in those with a familial history of glaucoma and individuals with hypermetropia.^{3,5}

In general, the management of glaucoma can be approached through three methods: medication, non-invasive measures like laser peripheral iridotomy (LPI), and invasive or operative interventions. Surgical procedures are indicated in cases of glaucoma where alternative treatments fail to sufficiently lower intraocular pressure (IOP) to prevent progressive damage to the optic nerve or loss of the visual field.³⁻⁶

METHODS

This research is a descriptive study using secondary data from electronic medical records, in the form of gender, age, diagnosis, and type of operative procedure. The inclusion criteria of this study were all patients with primary glaucoma who underwent surgery from January 2020 to December 2022. Exclusion criteria were patients with incomplete or unclear medical records. This research was approved by the Ethics Committee of RSUP Dr. Kariadi Semarang (DP.04.03/1/5313/2023)

RESULTS

Medical record data shows that there were 395 patients (395 eyes) with glaucoma who underwent surgery from January 2020 to December 2022. Subjects with PACG (67%) were more than subjects with POAG (33%).

Table 1. Characteristics of Primary Glaucoma Patients

Cases	POAG		PACG	
	n	%	n	%
	130	33	265	67
Gender				
Male	85	65	75	26
Female	45	35	190	74
Age Group				
1 – 10 years	1	1	0	0
11 – 20 years	9	7	0	0
21 – 30 years	13	10	0	0
31 – 40 years	7	5	0	0
41 – 50 years	14	11	30	11
51 – 60 years	26	20	112	43
61 – 70 years	54	41	94	35
71 – 80 years	5	4	27	10
81 – 90 years	1	1	2	1
91 – 100 years	0	0	0	0

In this study, stratified by gender, the male patient exhibited the highest number of POAG cases, whereas among PACG patients, women constituted the majority. Furthermore, regarding age distribution, the peak occurrence of POAG was observed within the 61-70 year age group, while the majority age group for PACG patients was 51-60 years.

Table 2. Intraocular POAG Patients Distribution based on Diagnosis

Type	n	%
POAG	89	68
JOAG	24	18
NTG	1	1
OHT	3	3
Absolute Glaucoma	13	10

Notes: Juvenile Open Angle Glaucoma (JOAG), Normotension Glaucoma (NTG), Ocular Hypertension (OHT)

Table 3. PACG Patients Distribution based on Diagnosis

Type	n	%
PACG	140	53
Creeping Type PACG	15	6
Post Acute PACG	27	10
PACG on Acute Exacerbation	19	7
APAC	25	10
PAC	6	2

PACS	3	1
Absolute Glaucoma	30	11

Table 4. Primary Glaucoma Patient Distribution based on Operative Procedure

	POAG		PACG	
	n	%	n	%
Trabeculectomy	49	37	30	11
Cataract Extraction with IOL insertion	20	16	35	13
Phacotrabeculectomy	42	32	161	61
Cyclocryotherapy	13	10	31	12
GDD Implantation	5	4	2	1
Goniosynechialysis +/- Cataract Extraction with IOL insertion	1	1	6	2

The most common operative procedure used in POAG patients is trabeculectomy, whereas in PACG patients it is a combination of trabeculectomy and cataract extraction with intraocular lens insertion (phacotrabeculectomy).

DISCUSSION

In the majority of cases, there is an elevation in intraocular pressure (IOP), which stands as a significant risk factor for optic nerve damage. The primary objective of glaucoma treatment is to maintain the IOP to prevent the advancement of nerve damage and preserve optimal visual function. This is typically accomplished by attaining and sustaining the designated IOP target, thereby minimizing fluctuations in IOP. Consequently, consistent monitoring of the target pressure is essential to assess the presence of IOP fluctuations, the progression of visual field disruptions, or alterations in the optic nerve.^{7,8}

This study revealed that the majority of POAG patients were in the age group of 61-70 years. These results align with prior research, indicating that the susceptibility to POAG tends to rise with advancing age.⁹ The progression of age-related physiological changes, alterations in ocular drainage structures, and elevated intraocular pressure are potential contributors to the elevated likelihood of POAG development among older individuals.⁷

Currently, one sole established treatment revolves around relieving IOP, which must be done prior to any damage to the optic nerve; because optic nerve damage is irreversible. Therapeutic options to lower IOP include medical interventions, laser procedures, and surgical measures. In this study, trabeculectomy emerged as the most prevalent intraocular surgery administered to patients with POAG. This aligns with the findings of Burr J. et al, who also highlighted trabeculectomy as the predominant surgical intervention for POAG.¹⁰

Trabeculectomy was chosen because of its efficacy in managing IOP in cases of POAG refractory to medical therapy or other alternative modalities. Moreover, in cases where POAG

patients require lens replacement due to cataracts, trabeculectomy is often undertaken concomitantly.¹¹ A study in Europe recommended surgery to be performed early in management, without the use of extensive drugs. Furthermore, a multi-center prospective cohort study conducted in Scotland reports better IOP control outcomes with early trabeculectomy when compared with conventional medical therapy.¹²

This study explores a range of approaches for managing primary open-angle glaucoma (POAG), including trabeculectomy, phacotrabeculectomy, cataract extraction with intraocular lens insertion, Cyclocryotherapy, glaucoma drainage device (GDD) implants, and goniosynechialysis. The shared objective of these therapies is the reduction of intraocular pressure (IOP). With the emergence of anti-scarring agents (5-fluorouracil, mitomycin C) for augmentation, trabeculectomy remains a successful surgical treatment for POAG. This study predominantly emphasizes trabeculectomy surgery, recognized as the suitable course of action for primary glaucoma patients unresponsive to medical treatment. Trabeculectomy surgery is favored over alternative methods due to its better safety profile and greater success rates. As a result, even amidst newer surgical techniques, trabeculectomy maintains its status as the preferred procedure, particularly for individuals with advanced glaucoma and rapidly progressing conditions.¹³

Several comparative studies between trabeculectomy and glaucoma drainage device (GDD) implantation have indicated superior outcomes with GDD implantation. However, the findings from these studies lack definitive conclusions, and surgical intervention is generally reserved for patients at a high risk of trabeculectomy failure—such as those with a history of previous trabeculectomy, uveitis, or aphakia. Additionally, other investigations have highlighted that reoperation rates tend to be higher among patients who have undergone trabeculectomy as opposed to GDD implantation. Implantation of GDD involves several considerations. It is typically indicated for patients with unsuccessful trabeculectomy and is avoided in individuals prone to infections. Moreover, complications like hypotonia and endophthalmitis can arise following GDD implantation. In the context of this study, the utilization of GDD was infrequent, in line with its role as a secondary option if trabeculectomy proves ineffective.¹⁴ Another commonly performed procedure on patients with primary open-angle glaucoma (POAG), as evidenced in this study, is phacotrabeculectomy. This surgical intervention involves addressing both the lens and performing trabeculectomy. Such combined surgery is frequently chosen for patients afflicted by glaucoma along with lens opacities. The phacotrabeculectomy technique, integrating trabeculectomy with cataract extraction and intraocular lens (IOL) insertion, holds the potential to optimize visual function.

Phacotrabeculectomy is preferred over other approaches such as phacoemulsification. Research reports phacotrabeculectomy is superior in reducing IOP and the use of glaucoma drugs after surgery.¹⁵

In the PACG group, the number of women who underwent surgery was more than men, namely 190 people (74%). This is different from the findings in PACG patients, where the number of male patients is greater. This variance can likely be attributed to distinct anatomical attributes and genetic predisposition between the two genders. Anatomically, there is a tendency for narrower iridocorneal angles in women, which might amplify the risk factor to PACG development.^{7-12,16}

Surgery stands as the primary therapeutic choice for PACG. The most common operative procedure performed on PACG patients in this study was a combination of trabeculectomy and cataract extraction with IOL insertion, known as phacotrabeculectomy. This integrated approach can be selected as the most effective therapeutic approach in treating PACG in cases where high IOP and the need for cataract surgery are major concerns.¹⁸ By performing these procedures simultaneously, patients can attain the optimal advantages in both controlling intraocular pressure and correcting impaired visual function due to cataracts.¹⁶ Cataract surgery in PACG patient presents a dual-purpose opportunity, allowing for the resolution of two issues through a single intervention: the restoration of vision and the elimination of narrow angles. Cataract extraction is progressively replacing the use of phacotrabeculectomy in PACG cases and is correlated with a reduction in IOP.¹⁹ Hence, cataract extraction can be used as a viable management strategy for PACG patients concurrently dealing with lens opacities. Recent research, conducted by the EAGLE study (Effectiveness in Angle-Closure of Lens Extraction), reports the lens's pivotal role in the progressive constriction of the iridocorneal angle. Due to its location behind the iris, the lens naturally thickens with age, contributing to the gradual narrowing of the drainage angle. Consequently, cataract extraction, with or without trabeculectomy, is recognized as an effective surgical intervention for the treatment of PACG.²⁰

In contrast to POAG, trabeculectomy surgery is not frequently performed in the context of PACG. In this study, trabeculectomy surgery did not emerge as the most prevalent procedure; instead, phacotrabeculectomy and cataract extraction with intraocular lens insertion were more common approaches. Cataract extraction in patients with glaucoma is a matter of consideration for surgeons seeking to prevent additional possible complications and optimize on favorable outcomes. Avoiding postoperative IOP spikes will protect many glaucomatous eyes from loss of visual function, and judiciously timed of cataract surgery can reduce the need for IOP-

lowering drugs. The choice of type and timing of surgery must offer the highest amount of benefit without compromising the potential for future glaucoma surgery.²¹

In this study, cyclocryotherapy was also used as a therapeutic approach. Nonetheless, a potential adverse outcome of this procedure is the harm it may cause to the surrounding trabecular meshwork due to the enlargement of the cryoablation area. As a result of this potential complication, cyclocryotherapy is rarely used in patients with PACG. It is typically considered when other options, such as trabeculectomy fails maintain IOP, and when the primary objective is not focused on restoring the patient's visual function.²²

On the other hand, some studies mention that cataract extraction role in reducing IOP in both PACG and POAG. However, operatively for POAG, cataract extraction alone does not always provide adequate IOP control. Moreover, performing cataract extraction concurrently with trabeculectomy in patients with POAG, although effective, has been noted to potentially disrupt filtering control. Studies conducted by Hennekes and Belgrado, as well as Velkrens, reported that cyclocryotherapy exhibits lower efficacy than trabeculectomy in reducing intraocular pressure (IOP). Cyclocryotherapy is predominantly employed in instances where alternative treatments have proven ineffective or are unsuitable—such as refractory glaucoma or scenarios where the risk of visual function loss is elevated. Nonetheless, this procedure is employed less frequently when compared to other operative treatments for glaucoma.²³

CONCLUSION

The most common surgical procedure performed on POAG is trabeculectomy and the most common procedure performed on PACG is a combination of trabeculectomy and cataract extraction with intraocular lens insertion (phacotrabeculectomy).

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