

## Surgery for Primary Open Angle Glaucoma (POAG) By Trabeculectomy: Indications and Results in 52 Cases

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### ABSTRACT

**Introduction:** POAG filtering surgery arouses a lot of interest regarding its indications and results in melanoderma subjects south of the Sahara. The aim of this work was to contribute to improving the management of this disease in our socio-economic environment.

**Material and Methods:** Retrospective longitudinal study carried out on the medical records of 47 patients and 52 eyes operated on for primary open-angle glaucoma by trabeculectomy from August 1, 2018, to August 31, 2020 in a private health facility, with postoperative follow-up of at least 1 year, for each case.

**Results:** The patients were aged 10 to 70 years (mean 62.5 +/- 13.81 years), with a male predominance (51.92%). Those who had health coverage were 44 (93.61%). Patients referred by other ophthalmologists for better care were 26 (55.31%). The mean preoperative IOP was 22.67 mm Hg.

The surgical indication was the failure of medical treatment marked by visual field degradation associated with uncontrolled IOP in 34 eyes (65.38%) and the patient's desire for 5 eyes (9.61%). And of the 52 operated eyes, 8 (15.39%) were under monotherapy, 30 under dual therapy (57.69%) and 14 (26.92%) under triple therapy. All eyes had undergone trabeculectomy, associated with the use of mitomycin C for the 52 eyes (100%). The postoperative IOP at 1 year of follow-up was between 10- and 15-mm Hg in 98.08% of cases with an average pressure drop of 8.67 mm Hg (38.24%).

**Conclusion:** A common practice of trabeculectomy with a view to refining the indications and mastering both the technique and the management of complications could make it a reliable alternative in the management of POAG in certain patients who are non-compliant or unable to cope the financial cost of medical treatment for life, in our conditions

### Keywords

Glaucoma, Trabeculectomy, Intraocular pressure, Glaucoma treatment.

### Introduction

Primary open-angle glaucoma (POAG) is a chronic and progressive anterior optic neuropathy that leads to progressive destruction of the optic nerve, under the influence of several risk factors, the main

of which is ocular hypertonia. It is characterized by pathological papillary excavation and visual field degradation [1]. POAG is the most common glaucoma of which it represents 50 to 70% of forms and is responsible for 6.4 million cases of blindness worldwide [2].

The natural progression of POAG is towards blindness and it is irreversible blindness. Its treatment, which aims to stabilize the

disease by acting on the main known risk factor, which is ocular hypertonia, is based on several means: medicinal, physical using lasers and surgery. Given its frequency, its management difficulties, and its prognosis, POAG constitutes a real public health problem in Africa south of the Sahara [3].

The drug treatment which is the first-line treatment for POAG generally consists of the single or multiple daily instillations of one or more eye drops and for life. This treatment, although effective in most cases when properly followed, poses problems of financial and sometimes geographical accessibility, impact on quality of life and compliance in people who are most often elderly, low-income, without health coverage and with comorbidity [4,5]. The laser, in particular “Selective Laser Trabeculoplasty” or SLT, opens great prospects in the treatment of POAG, as attested by Gazzard et al. [6]. However, this method still poses a problem of accessibility in low-income or medically under-equipped countries.

Surgery offers an additional possibility to the glaucomatologist, from classic trabeculectomy to the placement of drainage implants through so-called minimally invasive techniques. However, the last two categories would remain inaccessible for most incomes of Ivorian glaucoma sufferers, in a country where the minimum wage is 75,000 FCFA (114.34 Euros) per month. Trabeculectomy therefore remains the most accessible filtering surgical technique in our conditions, but it has indications that remain to be defined. Indeed, could it be the first-line treatment in certain patients objectively incapable of following drug treatment over the long term due to geographical distance, a financial inability to honor prescriptions and therefore condemned to be blind? This reality is opposed by the management of postoperative complications so feared by many ophthalmologists, the main of which is the failure of filtration due to excessive healing in the black people, leading to surgical revisions [7].

The aim of this work was to contribute to an improvement in the management of primary open-angle glaucoma in our conditions through an analysis of the indications and the evaluation of the results of trabeculectomy on intraocular pressure.

Materials and Methods

This was a retrospective longitudinal study based on the medical records of patients operated on in a private ophthalmological clinic in the city of Abidjan, one of whose branches of activity is the management of glaucoma. The study covered a period of two years from August 1, 2018, to July 31, 2020 for surgical interventions but the follow-up went beyond this period so that each case benefited from a one-year follow-up. All patients operated on for POAG during this period were systematically included in the study and the data studied were collected on an individual and anonymous survey form for each patient. No patient who underwent combined cataract-glaucoma surgery was included.

The variables studied were:

Sociodemographic data

Age, sex, level of education, socio-professional category, and existence of health insurance.

Clinical and Paraclinical data

The reason for consultation, refractive history, best corrected preoperative visual acuity, gonioscopy, preoperative intraocular pressure, preoperative vertical cup to disc ratio, central corneal pachymetry and visual field status.

Therapeutic data

The modalities of medical treatment before surgery, the indications for surgical treatment, the modalities of surgical treatment (use or not of antimitotic).

Evolutionary data

The best corrected visual acuity following surgery, the intraocular pressure following surgery, and the postoperative complications observed.

Results

Frequency

Out of 230 glaucoma patients who represented 4.63% of the patients followed during the study period, 47 were operated on for primary open-angle glaucoma including 42 unilateral cases and 5 bilateral cases, i.e. a total of 52 eyes which had benefited from the trabeculectomy.

Sociodemographic data

The patients were aged 10 to 73 years with an average age of 62.5+/- 13.81 years and the age groups of 50 to 80 years represented 76.8%. There were 25 male patients (53.20%) compared to 22 female patients (46.80%), i.e. a sex ratio of 1.13. The socio-professional categories were dominated by civil servants (23.40%) followed by retirees and actors in the informal sector (artisans, in general) with identical proportions of 21.27% (Table 1). Regarding the level of education, patients with higher and secondary education levels represented 74.46% with 42.55% and 31.91% respectively. Those at primary level represented 23.40% and only one patient had no education (2.12%). The patients who benefited from health coverage were 44 (93.61%) and among them, 32 were covered by the “Mutuelle Générale des Fonctionnaires de Côte d'Ivoire” (MUGEFCI, meaning “General Mutual of Public Servants in Côte d'Ivoire”, a compulsory public insurance for public servants in Côte d'Ivoire) alone (72.72%), 9 were covered by private insurance (20.45%) and 3 were covered both by MUGEFCI and by private insurance (6.81%).

Table 1: Distribution of patients according to occupation.

Occupation	Numbers	Frequency (%)
Tradespeople	8	17,02
People from informal sector	10	21.27
Pupils and students	2	3,85
Civil servants	11	23.4
Retirees	10	21.27
Others	6	12.76
TOTAL	47	100

Clinical data

Reasons for Consultations and Refractive History and Family History of Glaucoma

The main reason for consultation was the drop in visual acuity found in 39.13% of cases, followed by referral by a fellow ophthalmologist for an opinion and support, found in 26 patients but which represented 37.68% of cases. Reasons for consultations, a single patient being able to present several reasons for consultation (Table 2). As for the refractive history, out of 47 patients, 33 wore corrective lenses among which 29 were myopic (87.87%) and 4 were hyperopic (12.12%). They all had an addition for near vision. Family history of glaucoma was found in 14 patients (29.78%) of whom 8 had a glaucomatous father (57.14%), 5 had at least one glaucomatous collateral (35.71%) and one had a glaucomatous mother (7.14%).

Table 2: Distribution of patients according to reason of consultation in the clinic.

Reasons for consultation	Numbers	Frequency (%)
Drop of vision	27	39.13
Ocular pain	5	7.25
Referred for better treatment	26	37.68
Eye redness	6	8.69
Headache	5	7.25
TOTAL	69	100

Preoperative visual acuity

Out of 52 eyes, those whose visual acuity with the best possible correction was less than or equal to 3/10 were 27 (51.92%). Those for whom this visual acuity was between 4/10 and 7/10 represented 26.92% and those for whom it was greater than 7/10 represented 21.16% (Table 3).

Table 3: Distribution of eyes according to best corrected distance visual acuity BCVA) before surgery.

BCVA	Numbers	Frequency (%)
Hand movement perception	1	1.92
[1/20-1/10]	1	1.92
[1/10-3/10]	25	48.08
[4/10-7/10]	14	26.92
≥7/10	11	21.16
TOTAL	52	100

Preoperative intraocular pressure

Intraocular pressure between 20 mm Hg and 45 mm Hg was found in 41 eyes (78.84%) with an average intraocular pressure of 22.67 mm Hg (Table 4)

Table 4: Distribution of eyes according to preoperative intraocular pression (IOP).

IOP (mm Hg)	Numbers	Frequency (%)
[10-15]	2	4
[15-20]	9	17
[20-25]	15	29
[25-30]	17	33
[30-35]	5	9
[35-40]	1	2
[40-45]	3	6
TOTAL	52	100

Vertical cup/disc ratio

The cup to vertical disc ratio was greater than or equal to 7/10 in 47 eyes, or 90.38% of cases. In 5 eyes (9.62%), it was between 4/10 and 6/10.

Opening of the Iridocorneal Angle in Gonioscopy

The opening of the iridocorneal angle was grade 3 in 26 eyes (50%), grade 4 in 20 eyes (38.46%) and grade 2 in 6 eyes (11.53%).

Paraclinical Data (Central Corneal Pachymetry and Automated Visual Field)

Central corneal pachymetry was between 450 and 480 μm in 30 eyes (57.69%), between 480 and 550 μm in 24 eyes (26.92%) and greater than 550 μm in 8 eyes (15.38%). The automated visual field revealed severe glaucoma in 36 eyes (69.23%), moderate glaucoma in 14 eyes (26.92%) and early glaucoma in 2 eyes (3.84%).

Therapeutic data

Before surgery, the operated patients were under dual therapy for 30 eyes (57.69%), under triple therapy for 14 eyes (26.92%) and under monotherapy for 8 eyes (15.39%). Six eyes (11.53) had received SLT laser treatment, in addition to medical treatment. The indication for surgical treatment was dominated by the failure of medical treatment marked by visual field degradation associated with uncontrolled intraocular pressure in 39 eyes (75%). In 6 eyes (11.53%) the medical treatment associated with the laser was considered insufficient, in 5 eyes (9.61%) the surgical indication was based on the patients' desire to be operated on and for 2 eyes (3.85) the severe hypertonia motivated the surgical intervention.

The surgical procedure performed was trabeculectomy via conjunctival approach to the limbus. Associated with the use of mitomycin C on all eyes (100%) with releasable sutures of the scleral flap. After surgery, the patients received postoperative treatment consisting of corticosteroids combined with antibiotics, locally and systemically. The local treatment had an average duration of 45 days while systemic treatment lasted an average of 10 days.

Postoperative evolution

Visual acuity

Distance visual acuity with best correction was less than or equal to 1/20 at D1 in 27 eyes (51.92%), in 18 eyes at D7 (34.61%) and in 2 eyes at 1 year (3.84%). However, it was greater than or equal to 3/10 in 2 eyes at D1 (3.84%), in 6 eyes at D7 (11.53%) and in 36 eyes at one year (69.23%) (Table 5).

Intraocular pressure

Postoperative intraocular pressure was between 5- and 10-mm Hg in 40 eyes at D1 (76.92%), in 19 eyes at D7 (36.53%) and in no eyes at one year. However, it was between 10- and 15-mm Hg in 51 eyes (98.07%), with an average postoperative intraocular pressure of 14 mm Hg for all eyes. In one eye (1.92%), the intraocular pressure was between 20- and 25-mm Hg (Table 6).

**Table 5:** Distribution of eyes according to best corrected far visual acuity after surgery.

CFVA	Day 1		Day 7		1 month		3 months		6 months		1 year	
	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%
≤1/20	27	51.92	18	34.61	5	9.62	2	3.85	2	3.85	2	3.85
[1/20-3/20]	23	44.23	28	53.85	32	61.53	30	57.69	18	34.61	14	26.92
≥3/20	2	3.85	6	11.54	15	28.85	20	38.46	32	61.53	36	69.23
Total	52	100	52	100	52	100	52	100	52	100	52	100

**Table 6:** Postoperative intraocular pressure.

IOP	Day 1		Day 7		1 month		3 months		6 months		1 year	
	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%
[0-5]	2	3.85	2	3.85	0	0.00	0	0.00	0	0.00	0	0
[5-10]	40	76.92	19	36.54	9	17.31	0	0.00	0	0.00	0	0
[10-15]	10	19.23	27	51.92	35	67.31	42	80.77	51	98.08	51	98.08
[15-20]	0	0.00	4	7.69	7	13.46	9	17.31	0	0.00	0	0/00
[20-25]	0	0.00	0	0.00	1	1.92	1	1.92	1	1.92	1	1.92
Total	52	100	52	100	52	100	52	100	52	100	52	100

**Postoperative complications**

At one year of follow-up, complications were observed in 8 eyes (15.38%). These were intraocular inflammation in 3 eyes (37.5%), persistent hypotony without macular edema or choroidal folds in 2 eyes (25%), hypothalamia in 2 eyes (25%) and hypertonia in 1 eye (12.5%).

**Discussion**

**Frequency and Sociodemographic data**

**Frequency**

Glaucoma patients represented 4.63% of all patients consulted in the ophthalmological clinic where the study took place during the two years of the surgical management phase of the patients in this study. Gbé et al. [8] in Ivory Coast and Ellong et al. [9] in Cameroon found respectively prevalences of 3.48% and 4.5% of POAG. These data, which ours can be superimposed on, show that POAG is relatively common in our populations, especially when we know that it is underdiagnosed [10].

**Sociodemographic data**

The average age of patients with primary open-angle glaucoma was 62.5 years with extremes of 10 and 73 years. This average age is comparable to that found by Eballé [10] in Cameroon (62.20 years). These results confirm that POAG is a pathology that concerns people aged 40 and over much more. The coincidence of this period with the appearance of presbyopia would make it possible to take advantage of the recourse to the ophthalmologist for its correction to detect glaucoma [11]. As for gender, the male predominance in our study with 51.92% previously found by Gbé et al. in Ivory Coast [8] who found male predominance of 56.8% could be explained by greater financial autonomy men compared to women in many African societies. This relative autonomy in contexts where social coverage is sometimes rare, would give men more possibilities of being able to receive medical care. However, we note that in our series, only 3 patients out of 47 (6.38%) had neither private insurance nor public mutual insurance. This table poorly reflects the reality in the general population. Indeed, civil servants came to the fore even though they benefit from

compulsory coverage by MUGEFCI and the reception structure being a private clinic, there is a recruitment bias linked to the fact that this structure only selects " those who can pay", one way or another. Furthermore, we note that those who had a secondary level of education, at least, represented 74.46%.

**Clinical and Paraclinical data**

The patients who had consulted for a reduction in visual acuity were the most numerous with 39.13%. POAG is asymptomatic at the beginning stage. The presence of reduced visual acuity as the most frequent reason for consultation suggests that most of our patients consulted at an advanced stage of the disease, as this was confirmed by the analysis of the cup to vertical disc ratio which was greater than or equal to 7/10 in 90.38% of cases and the visual field reading which indicated severe glaucoma in 69.23% of cases.

In all cases, the refractive history dominated by myopia which in addition to being a risk factor, is a serious factor [12] show that the drop in near visual acuity which motivates a subject to consult the ophthalmologist over 40 years of age should be used to detect glaucoma. Patients who had been referred by other ophthalmologists for better care came second among reasons for consultation with 37.68%. This implies that these ophthalmologists encountered difficulties in the treatment of their glaucoma patients. Finally, corneal pachymetry revealed predominantly thin corneas with the consequence of an under-evaluation of the measured intraocular pressure. This data must be considered by any ophthalmologist performing ocular tonometry in a melanoderma subject.

**Therapeutic data**

Dual therapy was observed in most patients (57.69%), which is consistent with the literature. Indeed, Bron [13] and Wane [14] in their studies found 50.5% and 68% of dual therapy respectively. This was generally a combination of beta blockers and prostaglandins. The use of surgical treatment was motivated by a failure of medical treatment in 75% of cases followed by the insufficiency of medical treatment and/or laser (11.54%) and the patient's desire with 9.61%. These data confirm the great difficulty



in convincing patients of a threat of blindness while they “still see well” and have no ocular symptoms, in accepting the surgical solution in the treatment of glaucoma even if they are diagnosed early [15,16]. They also explain the scarcity of ophthalmologists practicing glaucoma surgery in Africa [17].

Trabeculectomy was performed in all our patients with the use of Mitomycin C in 52 eyes (100%). This intervention consists of creating a fistula between the anterior chamber and the subconjunctival space, thus allowing good filtration of aqueous humor and good control of intraocular pressure. Its long-term effectiveness, both in terms of pressure and functionality, would have shown its superiority compared to any other surgical treatment. However, it carries significant risks of early and late complications linked largely to “opening of the globe”. These risks of complications in patients who generally do not “request” the surgical solution would therefore prevent it from being offered as first intention. Furthermore, one of the rather feared complications in melanoderma subjects would be fibrosis followed by closure of this aqueous humor diversion pathway in the subconjunctival space leading to the failure of trabeculectomy. It is to prevent such failure that antimetabolites such as 5-Fluorouracil (5-FU) and Mitomycin C are applied intraoperatively to reduce the response of the healing process and therefore the failure of trabeculectomy [18].

## Data on postoperative evolution

### Visual acuity

Visual acuity on postoperative day 1 varied depending on our operated patients. In fact, more than half of the patients (51.92%) had visual acuity less than 1/20. This visual acuity on day 1, considered poor according to the WHO classification, would be the majority in the first days post-operatively due to the surgical trauma used leading to sudden decompression of the eyeball as well as the immediate consequences of the surgery which could result in edema. Post-surgical corneal associated with inflammation linked to manipulations in the anterior chamber and macular edema linked to the breakdown of the blood-retinal barrier. The gradual disappearance of postoperative corneal edema under treatment with corticosteroids combined with antibiotics allowed visual recovery in most of our patients who presented six months after glaucoma surgery with visual acuity considered good (61.54%) according to WHO standards (greater than 3/10). Improvement in visual acuity was observed in more than 69% of patients one year after glaucoma surgery (Table 5), which shows that more than 2/3 of the patients had good vision with the best correction.

### Evolution of intraocular pressure (IOP)

The IOP on postoperative day 1 varied according to our operated patients. In fact, more than half of the patients (76.92%) had an average IOP of 7.5mmHg followed by those with an average IOP of 12.4mmHg (19.23%). At 6 months postoperatively, 98.07% of patients had an average IOP of 13.84mmHg. However, we note the persistence of the IOP at 22mmHg in one of our patients, i.e. 1.92%. Gianoli, Demailly and Béchetoille respectively noted an

average of 11.5mm Hg, 15.7mmHg and 15.9mmHg, which makes our data consistent with the literature [19-21]. Preoperative IOP had an average of 22.67mmHg. After surgery, the postoperative IOP at 6 months had an average of 14mmHg which corresponds to a pressure drop of 8.67mmHg or 38.24%.

These results agree with those of the previously cited authors who respectively found a pressure drop of 15 (56%) then 8.3 (34.6%) and 5.8 (26.7%) [19-21]. By comparing our data with those of these authors, we can say that the surgery performed on these cases of glaucoma gave satisfactory results on intraocular pressure.

### Postoperative complications

Found after one year of follow-up, in 8 eyes (15.38%), it was inflammation of the anterior chamber, persistent hypotonia, hypothalamia and hypertonia. Inflammation of the anterior chamber came to the fore with 37.5%. These results are like that of Gianoli et al. who found 36.8% [19]. Ocular hypotony and hypothalamia were in second place with 25% each. These well-known complications after trabeculectomy glaucoma surgery were not associated with fundus abnormalities such as maculopathy or choroidal folds which would have worsened the prognosis.

### Conclusion

The weight of primary open-angle glaucoma in the burden of blindness in Africa south of the Sahara is surely underestimated. Indeed, in addition to the classic difficulty of accessing health services with qualified and sufficient human resources and appropriate technical platforms, there is the financial accessibility of these services for a large proportion of patients suffering from this disease. It is well established that the prevention of blindness due to glaucoma requires early diagnosis but also the establishment of health coverage mechanisms to make the cost of medical treatment which is the first-line treatment for glaucoma accessible. However, the absence or insufficiency of this coverage for a large part of the population exposes many glaucoma patients to certain blindness, due to an inability to bear the cost of treatment in the long term. For the latter, resorting to first-line surgery, particularly trabeculectomy, could be a solution. The results of this work open good prospects in this direction, given the beneficial effects of trabeculectomy on reducing intraocular pressure. Trabeculectomy must be encouraged in low-resource countries and particularly in Africa as well as work with a view to its evaluation in large series and in the long term. This work will not only make it possible to master surgical technique and the management of postoperative complications but also to refine the indications. Trabeculectomy could then be proposed as first intention in certain patients based on well-defined objective criteria.

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