



# A 5-year retrospective study of intraocular pressure control after trabeculectomy: a retrospective cohort study

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**Background:** Glaucoma is a group of diseases that damage the optic nerve in the eye, resulting in vision loss and, in severe cases, blindness. The prevalence of glaucoma and glaucoma blindness is highest in West Africans.

**Objective:** The study presents a 5-year retrospective analysis of intraocular pressure (IOP) and complications after trabeculectomy.

**Materials and methods:** Trabeculectomy was performed using 5 mg/ml of 5-fluorouracil. A gentle diathermy was performed to secure hemostasis. Using a blade fragment of the scleral thickness, a 4 × 3 mm rectangular scleral flap was dissected. The central part of the flap was dissected 1 mm into the clear cornea. Before being tailed down, the patient was given topical 0.05% dexamethasone qid, 1% atropine tid, and 0.3% ciprofloxacin qid for 4–6 weeks. Patients with pain were given pain relievers, and all patients with photophobia were given sun protection. A successful surgical outcome was defined as a postoperative IOP of 20 mmHg or less.

**Results:** There were 161 patients over the 5-year period under review, with men constituting 70.2% of the total. Out of 275 eyes operated on, 82.9% were bilateral cases, while 17.1% were unilateral. Glaucoma was found in both children and adults aged 11–82 years. However, it was observed to predominate between the ages of 51 and 60, with males having the highest incidence. The average preoperative IOP was 24.37 mmHg, while it was 15.24 mmHg postoperatively. The complication with the highest ranking was shallow anterior chamber (24; 8.73%) due to overfiltration, followed by leaking bleb (8; 2.91%). The most common late complications were cataract (32; 11.64%) and fibrotic bleb (8; 2.91%). Bilateral cataracts developed at an average of 25 months after trabeculectomy. It was seen in patients aged 2–3 with a frequency of 9, whereas 5 years after, 77 patients had improved vision, with a postoperative visual acuity of 6/18–6/6.

**Conclusion:** Postoperatively, the patients had satisfying surgical outcomes as a result of the decrease in preoperative IOP. Although postoperative complications occurred, they had no effect on the surgical outcomes because they were temporary and not optically threatening. In our experience, trabeculectomy is an effective and safe procedure for achieving IOP control.

**Keywords:** glaucoma, intraocular pressure, postoperative outcome, trabeculectomy

## Introduction

Glaucoma is a set of disorders that damage the optic nerve of the eye, resulting in vision loss and, in severe cases, blindness. Globally, it is one of the main causes of blindness<sup>[1,2]</sup>. Glaucoma affects 80 million individuals globally, and this estimate is

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## HIGHLIGHTS

- Intraocular pressure (IOP) was at its peak at 51–60 years, with males having the highest incidence.
- The patients were successfully managed with trabeculectomy, which is evident by the reduction in the IOP.
- The average preoperative IOP was 24.37 mmHg, while it was 15.24 mmHg postoperatively.

predicted to rise to more than 111 million by 2040<sup>[3]</sup>. West Africans have the highest prevalence of glaucoma and glaucoma blindness<sup>[4,5]</sup>. In comparison to other regions, glaucoma cases in Africans have higher intraocular pressure (IOP) and occur at a younger age<sup>[5]</sup>. It progresses more quickly and presents late in the disease's course, with up to 50% of patients already blind in one eye at presentation<sup>[4]</sup>. In Nigeria, glaucoma accounts for 0.7% of blindness in people aged 40 and above<sup>[6]</sup>. Blindness caused by glaucoma has a significant public health effect. The only evidence-based approach to treating glaucoma is to lower IOP<sup>[7,8]</sup>. Trabeculectomy is the most commonly used filtering surgery<sup>[9]</sup> and is considered the gold standard for patients with progressive glaucoma who have not responded to medical or laser

treatment<sup>[10]</sup>. Trabeculectomy, which has been shown to be more beneficial in Africans in terms of lowering IOP and slowing field loss<sup>[11,12]</sup>, reduces IOP by creating a continuous flow of aqueous from the anterior chamber (AC) to the subconjunctival space<sup>[13–15]</sup>. Despite the recent development of new micro-invasive procedures<sup>[16]</sup>, trabeculectomy is the glaucoma procedure in our center as a low-resource setting. Our center has made significant efforts to perform the surgeries in order to achieve a controllable outcome, while also considering IOP when determining successful surgeries<sup>[17–19]</sup>. On that note, and in addition to the objective of adding to the data repository on trabeculectomy postoperative complications and outcomes, this study aimed to present a 5-year retrospective study of IOP control after trabeculectomy.

**Materials and methods**

**Ethical consideration, inclusion and exclusion criteria**

This retrospective study was approved by the ethics committee of the hospital in 2017 and followed the principles of the Helsinki Declaration. This work fully complies with the STROCSS (strengthening the reporting of cohort, cross-sectional and case-control studies in surgery) 2021 requirements and is reported in accordance with the STROCSS criteria<sup>[20]</sup>. This research was retrospectively registered at <https://www.researchregistry.com/register-now#user-researchregistry/registerresearchdetails/63ecab1e202dd4002803a2a7/>, with the Research Registry Unique Identifying Number: 8682. The study included all patients who had a 5-year follow-up. They were phakic patients who had their first surgery at our facility. Patients who had repeat surgery, pseudophakics, or who did not finish the 5-year follow-up period were excluded from the study. Before surgery, all of the patients were on medication, some from other centers, with progression in the visual fields and optic nerve head. Those whose blood pressure was more than 20 mmHg were put on medication following surgery.

**Study design and procedures**

This is a retrospective cohort study in which the files of 161 patients who underwent trabeculectomy with 5-fluorouracil 5 mg/ml were identified from the theater records and those with a follow-up period of up to 5 years (2017–2022) were included. In this study, success was defined as having an IOP of 20 mmHg or less. Glaucoma was diagnosed by IOP, central visual field 24-2, and cupped disk ratio (CDR) by ophthalmoscopy and optical coherence tomography (OCT). Releasable suture was used to control overfiltration.

A 6/0 vicryl affixed to the drape was used to place a corneal traction suture, and a fornix base conjunctival flap was raised nasally. Hemostasis was secured by cautery. A rectangular scleral flap of 4 × 3 mm was dissected with a razor blade fragment half the scleral thickness; the central part of the flap was dissected 1 mm into the clear cornea. An antimetabolite sponge was placed under the flap and covered with the conjunctiva for 3 min, after which the area was well irrigated with a 10-ml syringe of balance salt solution (BSS) for 30 s. This was followed by a paracentesis with a 23-gauge needle for 2 h, from the scleral flap, and the anterior chamber was formed with BSS.

**Table 1**  
Demographic characteristics of the patient

Age range	Frequency	Gender	
		M	F
11–20	8	2	6
21–30	8	6	2
31–40	15	14	1
41–50	24	14	10
51–60	55	39	16
61–70	38	29	9
71–80	12	8	4
81–90	1	1	0

F, female; M, male.

A 30° side port knife was used to enter the AC at the center of the flap. Kelly’s punch (1 mm) was used for trabeculectomy, and DeWecker scissors was used for iridectomy. The scleral flap was closed with 9/0 nylon and a releasable suture at one end, and the conjunctival flap was closed with 9/0 nylon. The AC was formed using BSS via paracentesis, and intracameral antibiotics of 0.1 ml of 5 mg/ml ceftriaxone were given, followed by a subconjunctival injection of 2 mg dexamethasone and 20 mg gentamycin, and a drop of 0.3% ciprofloxacin and 1% atropine. For 24 h, the eye was covered with a gauze and strapped in place with an eye shield.

The following day, the eye was opened and examined for the presence of bleb, corneal clarity, deep AC, flare in the AC, pupil size, lens clarity, and IOP. The patient was given topical 0.05% dexamethasone qid, 1% atropine tid, and 0.3% ciprofloxacin qid for 4–6 weeks before being tailed down. Pain reliever was given to patients with pain, and sun protection was given to all patients with photophobia. The long-term complications that the patients have encountered are presented and discussed.

**Results**

This study included a total of 161 patients, with 113 (70.2%) being male and 48 (29.8%) being female. There were a total of 275 eyes examined. Bilateral cases constituted 114 (82.9%) of all patients, while unilateral cases constituted 47 (17.1%), with 137 (49.8%) right eye (RE) and 138 (50.2%) left eye (LE) cases. The patients ranged in age from 11 to 82 years, with a mean of 53 years and a standard deviation of 53.17 ± 15.26 years (Table 1).

**Table 2**  
The preoperative intraocular pressures of the right and left eyes

Right eye				Left eye			
IOP	Frequency	M	F	IOP	Frequency	M	F
0–10	3	3	0	0–10	0	0	0
11–20	50	38	12	11–20	57	39	18
21–30	62	40	22	21–30	53	36	17
31–40	14	9	5	31–40	18	13	5
41–50	7	5	2	41–50	9	6	3
51–60	1	0	1	51–60	1	0	1

F, female; IOP, intraocular pressure; M, male.

**Table 3**  
The postoperative intraocular pressures of the right and left eyes

Right eye				Left eye			
IOP	Frequency	M	F	IOP	Frequency	M	F
0–10	39	27	12	0–10	37	27	10
11–20	87	59	28	11–20	92	61	31
21–30	9	6	3	21–30	9	7	2
31–40	1	1	0				
41–50	1	1	0				

F, female; IOP, intraocular pressure; M, male.

The preoperative IOP for the RE was 24.34 mmHg on average, with a standard deviation of 24.34 ± 8.48 mmHg as presented in Table 2. The preoperative IOP for the LE was 24.39 mmHg, with a standard deviation of 24.39 ± 9.14 mmHg (Table 2). Postoperatively, the average IOP was 15.24 mmHg, with a standard deviation of 15.24 ± 5.72 mmHg (Table 3), while the LE had an average pressure of 13.92 mmHg, with a standard deviation of 13.92 ± 4.54 mmHg, as shown in Table 3. Table 4 displays the various average IOPs.

Shallow AC (24; 8.73%) was the most common early complication, followed by leaking bleb (8; 2.91%). Uveitis (3, 0.73%), corneal ulcer (3; 1.09%), and hyphema (3; 1.09%) were among the complications, but they were less common (Table 5). Cataract (32; 11.64%) and fibrotic bleb (8; 2.91%) were the most common late complications (Table 6). Corneal ulcer, iris incarceration at the osteom, and painful blind eye were the least common (1; 0.36%). There were nine cases of cataract developed after trabeculectomy, with patients aged 2–3 having the highest frequency of 9. Patients aged 4–5 had no cases of cataract (Table 7). A summary of visual acuity 5 years after trabeculectomy is provided in Table 8, with 28% (77) of patients having improved vision.

**Discussion**

The results in this report are from a 5-year retrospective analysis of IOP control following trabeculectomy at our center. Our findings revealed that glaucoma was more prevalent in the middle-aged and elderly groups (51–60), as shown in Table 1. Within this age group, the proportion of men with glaucoma (39) was

**Table 4**  
Patients' average preoperative and postoperative intraocular pressures

Age range	Frequency	Average preoperative IOP (mmHg)	Average postoperative IOP (mmHg)
11–20	8	26.25	11.86
21–30	8	25.88	13.81
31–40	15	20.07	15.53
41–50	24	24.85	15.33
51–60	55	24.96	14.39
61–70	38	24.39	14.34
71–80	12	24.63	13.40
81–90	1	24.50	07.00

IOP, intraocular pressure.

**Table 5**  
Early complications

Complication	RE	LE	Total, N (%)
Shallow AC due to malignant glaucoma	1	1	2 (0.73)
Uveitis	3	0	3 (0.73)
Corneal ulcer	1	2	3 (1.09)
Leaking bleb	3	5	8 (2.91)
Shallow AC due to overfiltration	16	8	24 (8.73)
Hyphema	1	2	3 (1.09)

AC, anterior chamber; LE, left eye; RE, right eye.

higher than the proportion of women (16) with glaucoma (27.6% vs. 11.3%). According to the Vision Health Initiatives report, anyone can develop glaucoma; however, certain populations are more vulnerable, such as African Americans over the age of 40 and individuals over the age of 60<sup>[21]</sup>. Our findings are consistent with the Vision Health Initiative report and previous reports that it occurs in younger people<sup>[5]</sup> and in those over the age of 40<sup>[6,22]</sup>. Our findings showed that men are more likely than women to have glaucoma, which is consistent with the findings of Khachatryan *et al.*<sup>[23]</sup>, who investigated the relationship between gender and primary open-angle glaucoma (POAG) in African Americans. It was observed that the male gender was significantly associated with the risk of POAG, the most common type of glaucoma<sup>[23]</sup>. In contrast to these findings, there is inconsistency in the gender that is predisposed to glaucoma. According to Vajaranant *et al.*<sup>[22]</sup>, women are more likely to develop angle closure glaucoma than men, but there is no clear gender preference for open-angle glaucoma.

IOP is an important factor in assessing patients at risk of glaucoma. Glaucoma was confirmed preoperatively by measuring IOP, which was found to be abnormally high with values above 21 mmHg in the eyes of a large population of 53–62 patients, particularly the male gender (Table 2). In a parallel comparison with postoperative surgical outcomes (Table 3), IOP was reduced to a normal level of 15.24 mmHg for the RE and 13.92 mmHg for the LE, both with *P* values of 0.05. The number of patients with normal IOP values for the REs increased significantly, reaching 15 and 56 down the column of the Table, respectively, and 36 and 94 for the LEs. The return of IOP to normal levels indicates a successful surgical outcome in glaucoma surgery using trabeculectomy<sup>[9,10,24]</sup>.

As shown in Table 3, the IOP was not completely restored to normal in all patients. A pressure of 21–30 mmHg was recorded in five patients, while 15 patients had a higher IOP of

**Table 6**  
Late complications

Complication	RE	LE	Total, N (%)
Blebitis	2	0	2 (0.73)
Painful blind eye	1	0	1 (0.36)
Cataract	19	13	32 (11.64)
Fibrotic bleb	3	5	8 (2.91)
Iris incarceration	0	2	2 (0.72)
Leaking bleb	1	1	2 (0.36)
Endophthalmitis	1	1	2 (0.73)
Corneal ulcer	0	1	1 (0.36)

LE, left eye; RE, right eye.

**Table 7**  
**The occurrence of cataracts following trabeculectomy**

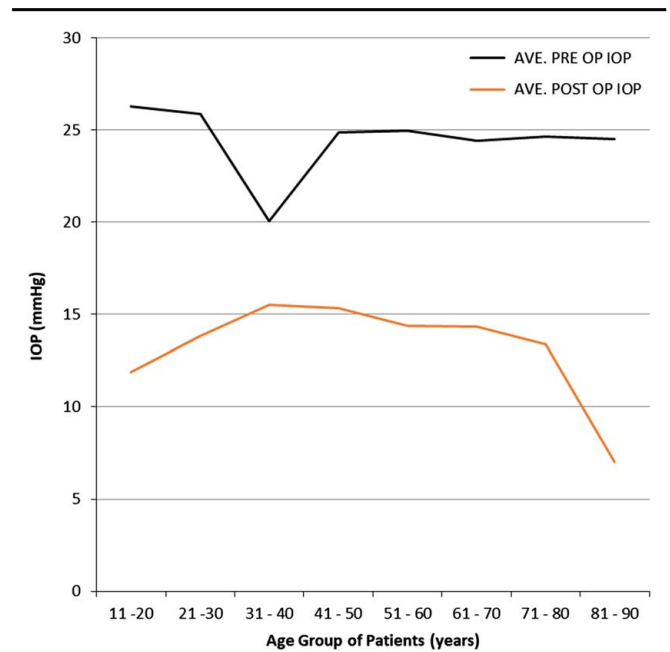
Age (year)	Frequency
0-1	7
1-2	6
2-3	9
3-4	0
4-5	3

41–50 mmHg. Only nine patients had an abnormal IOP of 21–30 mmHg in the LE. Although the primary goal of glaucoma treatment to reduce IOP and preserve visual function<sup>[25,26]</sup> was achieved in this study, some patients had abnormal IOP after surgery (Table 3). This suggests that ocular hypertension had occurred, which is one of the predictors of postoperative IOP elevation<sup>[26]</sup>. However, the IOP returns to normal with time<sup>[27]</sup>. In our study, trabeculectomy resulted in a satisfactory surgical success rate, with an overall IOP reduction average of 14.35 mmHg (Table 4 and Fig. 1).

Although trabeculectomy is a viable surgical option for treating glaucoma, it is not without side effects, which manifested as postoperative complications, as shown in Tables 5 and 6. The most common early postoperative complications were shallow AC (24; 8.73%) and leaking bleb (8; 2.91%), while cataract (32; 11.64%) and fibrotic bleb (8; 2.91%) were the most common late postoperative complications (Table 6). Our findings are consistent with previous studies, which found that shallow AC (13 eyes; 17.1%) was the most common early postoperative complication<sup>[13,28,29]</sup>. The reported early complications were transient in nature, and included minor complications such as uveitis, corneal ulcer, and hyphema in addition to the major complications. Other studies from Nigeria<sup>[29]</sup> and North America<sup>[28]</sup> found a similar pattern of fewer hyphema cases. This pattern has been attributed to ophthalmologists’ good surgical techniques and preventative measures<sup>[13]</sup>, which are followed in our center. Various types of complications have been reported following trabeculectomy, with the incidence varying depending on the length of follow-up, the study population, and surgical techniques such as the use of antimetabolite and releasable sutures<sup>[13,30–32]</sup>. A summary of the occurrence of cataract following trabeculectomy is presented in Table 7; while patients of various ages developed cataract, those aged 4–5 were cataract-free. Transient side effects after trabeculectomy are common and can last up to 2 years<sup>[33,34]</sup>. The majority of the complications were temporary and self-limiting. After surgery, 57 (20.73%) patients had poor vision, 51.27% had the same vision as before, and 28% had improved vision (Table 8). Patients with improved vision were a step or two better than their pre-intervention vision. This is due to the fact that the majority of patients had extremely high IOPs, which were reduced with a systemic hyperosmotic

**Table 8**  
**Corrected visual acuity at 5 years versus the presenting vision**

Visual acuity	Number	Percentage
Number of patients with better vision than presenting vision	77	28
Number of patients with the same vision as presenting vision	141	51.27
Number of patients with poor vision than presenting vision	57	20.73



**Figure 1.** A graph depicting the average intraocular pressure of patients before and after surgery. IOP, intraocular pressure.

agent prior to surgery. It has been reported that trabeculectomy causes transient vision loss, with recovery times ranging from 6 to 720 days<sup>[33,34]</sup>.

In this study, the patients were followed-up for 5 years. Those with IOPs greater than 20 mmHg were prescribed medication, accounting for ~11% of all eyes. Jung *et al.*<sup>[24]</sup> reported that trabeculectomy required less postoperative IOP-lowering medications.

It is known that some patients experience vision loss following trabeculectomy; those who experienced vision loss were among those who received topical medicine to manage their pressure after surgery. Clear lens extraction is an option<sup>[35]</sup>; however, it imposes a greater financial burden on patients due to intraocular lens (IOL) insertion. Microinvasive glaucoma surgery (MIGS) is a possibility<sup>[36]</sup>, but it is beyond the reach of our institute. We intend to collaborate with other institutions in order to acquire MIGS skills. Also, exploring the use of a 23-gauge cystotome to perform goniotomy in a glaucoma patient is an intriguing idea<sup>[36]</sup>. It has been demonstrated that cystotome can make MIGS more accessible to Africa, African Diaspora countries, and low-income developing countries<sup>[36]</sup>.

The retrospective aspect of this study is one of its limitations. More specifically, the difficulties of ophthalmological practice in a resource-constrained situation, such as the inability to perform trabeculectomy with phacoemulsification and goniotomy in a single sitting, which would have produced a superior outcome.

**Conclusion**

In our center, trabeculectomy is a viable surgical option for treating glaucoma. It resulted in positive postoperative surgical outcomes for IOP reduction, with transient complications that did not pose a visual threat. In this study, those that have an IOP less than 20 mmHg had stable visual acuity and fields.

**Ethical approval**

This study adhered to the principles of the Helsinki Declaration and was approved by our institution's ethical committee with approval number: ECWA/EH/0034/2017.

**Consent**

Not applicable.

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This work did not receive any external funding.

**Author contribution**

M.O.A., A.J.O., and E.O.B.: conceptualization; M.O.A., A.J.O., S.E., and N.S.: methodology; M.O.A., A.J.O., U.I., O.K., and O.E.O.: experiments; M.O.A., A.J.O., I.M.M., and J.D.P.: data curation and formal analysis; E.J.D.: writing – original draft preparation; M.O.A., E.O.B., and E.J.D.: writing – reviewing and editing; J.D.P., E.J.D., M.O.A., A.J.O., and E.O.B.: statistical analysis and validation.

**Conflicts of interest disclosure**

There are no conflicts of interest to declare.

**Guarantor**

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