



# Intraocular Pressure Reduction and Complications Profile of Trabeculectomy with 5 Fluorouracil Versus Phaco-trabeculectomy with 5 Fluorouracil in Nigerian Glaucoma Patients

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## Authors' contributions

This work was carried out in collaboration between both authors. The article conceptualization, data collection and processing, and the writing of the initial draft were done by author AO. Author GIN did the literature search then reviewed and wrote the final draft. Both authors read and approved the final manuscript.

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## ABSTRACT

**Aims:** To evaluate the surgical outcome of combined phacoemulsification cataract surgery plus posterior chamber intraocular and trabeculectomy with adjunctive 5-Fluorouracil versus trabeculectomy with 5-Fluorouracil in the management of Primary open angle glaucoma.

**Study Design:** it was retrospective comparative interventional study

**Place and Duration of Study:** Glaucoma Unit, Eye foundation Hospital Ikeja, Lagos, Nigeria between January 2015, and December 2017

**Materials and Methods:** A retrospective review of consecutive 29 eyes (29 patients) who had trabeculectomy with 5-Fluorouracil compared with 26 eyes (26 patients) who had combined phacotrabeulectomy with 5-Fluorouracil from 2015 to 2017. All patients had a minimum follow up of 3 months.

**Results:** The mean age of 54.48±14.42 years in Trabeculectomy group was significantly ( $p>0.001$ ) lower than 70.76±7.22 years for the Phacotrabeculectomy group. The mean preoperative intraocular pressure (IOP) and number of glaucoma medication were similar for the two groups (19.86±9.63mmHg versus 22.23±8.99mmHg; 2.66±1.20 versus 2.73±0.72 medication, trabeculectomy versus phacotrabeculectomy respectively). The postoperative IOP and glaucoma medication after a mean follow up period of 17.11±9.81 months was not significantly different between the two groups (11.55±2.71mmHg versus 12.31±4.33mmHg,  $p=0.436$  for trabeculectomy versus phacotrabeculectomy respectively). Both groups significantly required fewer number of antiglaucoma medication at final follow-up (1.14±0.92 vs 1.46±1.10, trabeculectomy vs phacotrabeculectomy. In the trabeculectomy group, 25 (86.2%) had IOP of  $\leq 15$ mmHg with or without topical antiglaucoma drops. In the phacotrabeculectomy, 21 (80.76%) had IOP of  $\leq 15$ mmHg with or without topical antiglaucoma medication (Qualified success). On the other hand, 8 (27.58%) had IOP of  $\leq 15$ mmHg without topical antiglaucoma medication at the end of the follow-up in the trabeculectomy (Complete success). In the phacotrabeculectomy group, 5 (19.23%) had final IOP of  $\leq 15$ mmHg without topical antiglaucoma medication.

Few complications occurred in both groups.

**Conclusion:** Phacotrabeculectomy augmented with 5-Fluorouracil gave comparable surgical success to 5-Fluorouracil augmented trabeculectomy alone.

*Keywords: Trabeculectomy; phacotrabeculectomy; 5-fluorouracil; glaucoma patients.*

## 1. INTRODUCTION

Trabeculectomy is the most performed glaucoma surgery and considered as the gold standard [1]. Glaucoma and cataract frequently coexist. There is usually a dilemma of whether to combine both trabeculectomy with cataract surgery in these patients [2]. Phacoemulsification with posterior intraocular lens alone has been noted to result in a sustained intraocular pressure reduction of 1.5mmHg in Primary open angle glaucoma [2]. Studies have shown that both trabeculectomy (trab) and phacotrabeculectomy (phaco-trab) are effective in reducing IOP in patients on maximally tolerated glaucoma medications [2,3].

Cataract and glaucoma are leading causes of blindness worldwide, and their co-existence is common in elderly people [4]. Glaucoma surgery can accelerate cataract progression and performing both surgeries may increase the rate of postoperative complications and compromise the success of either surgery [2]. Some studies have shown that patients with Primary Open Angle Glaucoma (POAG) who had cataract surgery experience a small drop in intraocular pressure (IOP) and reduction in the use of topical antiglaucoma medication, but this is said to be uncommon and usually occurs 1 to 2 years after surgery [5,6]. The decision between undergoing combined glaucoma and cataract surgery versus glaucoma surgery alone is complex. Therefore, it is important to compare the effectiveness of these two interventions to aid clinicians and patients in choosing the better treatment approach.

The level of intraocular pressure (IOP) correlates with the risk of development of glaucoma and progression of glaucoma [7,8]. Lowering IOP can prevent the development of glaucoma in eyes with elevated IOP and slow the worsening of glaucoma in eyes with established glaucoma damage [7-9].

## 2. METHODOLOGY

It was a retrospective comparative interventional non-randomized study. The medical files of patients who had trabeculectomy and phacoemulsification cataract surgery combined with trabeculectomy between January 2015 to December 2017 at Eye Foundation, Ikeja, Lagos Nigeria were reviewed. The procedures carried out in this study involving human subjects followed the ethical standards of the hospital and the tenets of the Helsinki Declaration. Informed consent for the study was not taken from every individual in this study because it a retrospective review. However, all subjects gave informed consent for the surgeries at the time they were performed.

Preoperative data collected included patient demographic information (age, gender), glaucoma type and severity, number of current IOP lowering medications, past ocular surgical history, and baseline visual acuity and intraocular pressure (IOP) obtained by Goldmann applanation tonometer. Postoperative data collected included, type of surgery, ocular and systemic medications, visual acuity, IOP, any

new adverse events, and any secondary surgical interventions for IOP control. Also collected was number of bleb needling.

Only patients with minimum of 3 months follow-up were included in the study.

## 2.1 Surgical Techniques

All the surgeries were performed by an experienced Glaucoma and Cataract surgeon (OA) using the same methods. The surgeries were performed using subtenon anaesthesia.

1. **Trabeculectomy:** Following routine cleaning draping, Simpson's self-retaining eyelid speculum was placed. With the eye well anaesthetized, superior cornea traction suture using 8/0 vicryl was placed to stabilize the globe. A 6mm Fornix-based conjunctival peritomy fashioned and haemostasis achieved with gentle cautery. A half thickness 4x3millimeter scleral flap was raised and application of 50mg/ml 5-Fluorouracil was applied over the sclera for 3 minutes and irrigated with at least 20mls of balanced salt solution (BSS). A paracentesis performed with 23-gauge needle and then a 1x1milliliter of deep sclerotomy was performed into the anterior chamber using Kelly's punch and peripheral iridotomy done with curved iridectomy scissors. The scleral flap was sutured with two fixed 10/0 nylon suture and 2 releasable sutures. The conjunctival was closed with 10/0 nylon suture.
2. **Phaco-trabeculectomy:** A two-site phaco-trabeculectomy was performed in a three-stage procedure. The first was preparation of the trabeculectomy, which included a fornix-based 6mm conjunctival incision followed by mild cautery. Then, a creation of a 4x3mm half thickness scleral flap and application of 50mg/ml 5 FU for 3minutes was performed. The second stage is a standard phacoemulsification with the capsular bag using the divide and conquer technique. Phacoemulsification was done in a second site through a temporal clear cornea incision far away from the trabeculectomy site. In the third stage, the scleral flap was elevated and a posterior sclerotomy was performed with Kelly punch. Peripheral iridotomy was done with curved Vannas scissors. The scleral flap was sutured with two fixed 10/0 nylon

suture and 2 releasable sutures. The conjunctival was closed with 10/0 nylon suture.

**Postoperative follow-up:** The eyes were placed on Guttae Maxidex (Alcon) initially 2hourly and tailed over a 3month period. Topical Ciprofloxacin (by Alcon) q.d.s for a period of month was also given. Only patients with a minimum follow-up of 3 months were included for analysis. During each of these follow-ups, visual acuity, a complete slit-lamp evaluation and Goldmann applanation tonometry were performed, and if needed, additional surgical interventions (release of sutures, bleb needling) were performed. The primary outcome of the study was the overall IOP lowering in the two groups at last follow-up visit. Complete and qualified success rates were defined as an IOP of  $\leq 15$  mmHg without or with medications, respectively. Failure is defined as IOP reduction of IOP value of  $< 6$ mmHg.

## 2.2 Statistical Analysis

All data were cross checked for accuracy entered in a proforma and were analyzed using commercially available statistical data management software- Statistical Package for Social Sciences (IBM-SPSS) version 25. Continuous variables were illustrated in the form of mean  $\pm$ SD and categorical variables were shown in the form of frequency and percent. Comparison among continuous data was done using Anova, whereas categorical data were analyzed using  $\chi^2$ -test. *P* value less than 0.05 was considered statistically significant.

## 3. RESULTS

A total of 55 eyes of 55 patients were included in the study. Twenty-nine of the patients had trabeculectomy while 26 had combined phacoemulsification and trabeculectomy with 5 Fluorouracil applied in all cases. There was statistically significant difference in the mean age between the two groups with those who had Phaco-trabeculectomy being older than those who had trabeculectomy as shown in Table 1. There were no statistically significant differences between the mean preoperative intraocular ( $p=0.352$ ) and the mean preoperative number of topical antiglaucoma medication ( $p=0.782$ ) between the two groups. Most of the patients had Advanced glaucoma. Other demographic and clinical profiles were as shown in Table 1.

**Table 1. Demographic and clinical characteristics of the patients**

Characteristics	Type of surgery		p-value
	Trabeculectomy	Phacotrabeculectomy	
<b>No of eyes (No of patients)</b>			
<b>Age (years)</b>	<b>29</b>	<b>26</b>	
Mean±SD	53.66 ± 14.09	70.62 ± 7.52	0.001*
<b>Gender (n, %)</b>			
Male	21 (72.41)	16 (61.54)	
Female	8 (27.59%)	10 (38.46)	
Total	29	26	
<b>Eye (n, %)</b>			
Right	14 (48.28)	12 (46.15)	
Left	15 (51.72)	14(53.85)	
<b>Glaucoma severity</b>			
Mild POAG (n, %)	5 (17.24)	2 (7.69)	
Moderate POAG	4 (13.79)	5 (19.23)	
Advanced POAG	20(68.97)	19 (73.08)	
<b>Preoperative intraocular pressure</b>			
Mean±SD	19.86 ± 9.63	22.23 ± 8.99	0.352
<b>Number glaucoma medications</b>			
Mean±SD	2.66 ± 1.20	2.73 ± 0.72	0.782
Decimal BCVA			
Mean±SD	0.59 ± 0.33	0.24 ± 0.19	0.001*

\*Statistically significant ( $p < 0.05$ )**Table 2. Postoperative clinical data**

Characteristics	Type of surgery		p-value
	Trabeculectomy	Phacotrabeculectomy	
<b>Follow-up (Months)</b>			
Mean±SD	16.03 ± 10.09	18.31 ± 9.55	0.396
<b>Intraocular pressure</b>			
Mean±SD	11.55 ± 2.71	12.31 ± 4.33	0.436
<b>Number glaucoma medications</b>			
Mean±SD	1.14 ± 0.92	1.46 ± 1.10	0.240
Needling (No)	5	0	
Decimal BCVA			
Mean±SD	0.59 ± 0.36	0.54 ± 0.34	0.63

\*Statistically significant ( $p < 0.05$ )

There was no statistically significant difference ( $p=0.396$ ) in the mean follow-up period for the two group. There was also no statistically significant difference in the postoperative mean intraocular pressure ( $p=0.436$ ) and mean topical antiglaucoma medications ( $p=0.240$ ) between the two groups as shown in Table 2. See also Figs. 1 and 2.

In the trabeculectomy group, at the end of the follow-up, there was a statistically significant ( $p < 0.001$ ) drop in the mean IOP of 8.31mmHg (41.84%) from the preoperative value. Similarly, in the Phaco-trabeculectomy group, the mean IOP dropped significantly by 9.92mmHg (44.62%,  $p < 0.001$ ). The topical antiglaucoma usage dropped by 1.52 (57.14%,  $p < 0.001$ ) and 1.27 (46.52%,  $p < 0.001$ ) from the preoperative

values in the trabeculectomy and phaco-trabeculectomy groups, respectively.

In the trabeculectomy group, 25 (86.2%) had IOP of  $\leq 15$ mmHg with or without topical antiglaucoma drops. In the phacotrabeculectomy, 21 (80.76%) had IOP of  $\leq 15$ mmHg with or without topical antiglaucoma medications (Qualified success). On the other hand, 8 (27.58%) had IOP of  $\leq 15$ mmHg without topical antiglaucoma medication at the end of the follow-up in the trabeculectomy (Complete success). In the phacotrabeculectomy group, 5 (19.23%) had final IOP of  $\leq 15$ mmHg without topical antiglaucoma medications.

Five eyes in the Trabeculectomy group had bleb needling with postoperative 5-FU injection. No

eye in the Phacotrabeculectomy group had any bleb needling.

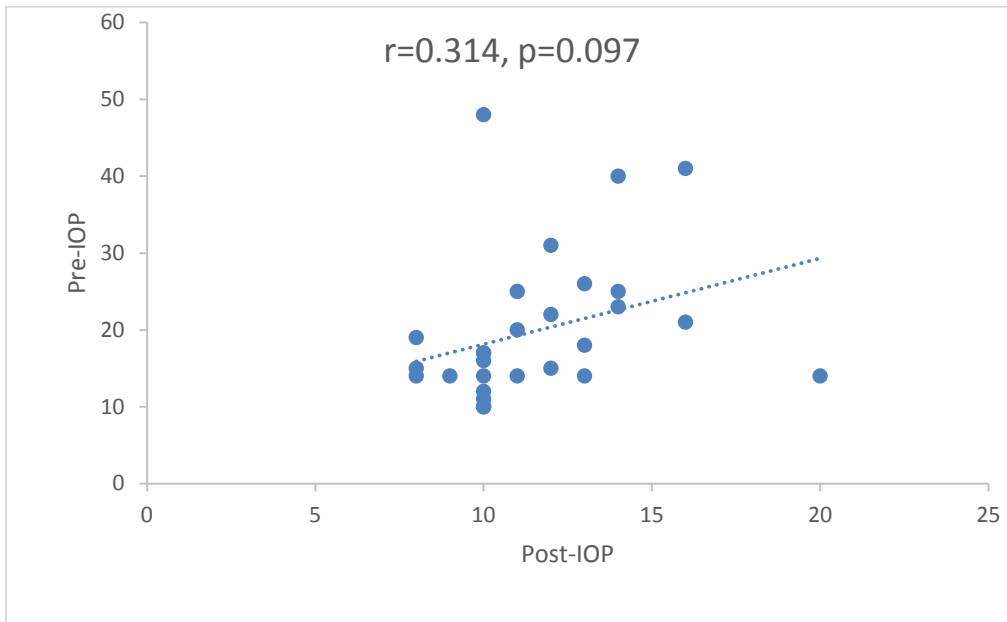
### 3.1 Additional Procedure to Lower IOP

In the trabeculectomy group, 3 eyes (patients) had phacoemulsification and posterior intraocular lens implant while in the Phacotrabeculectomy

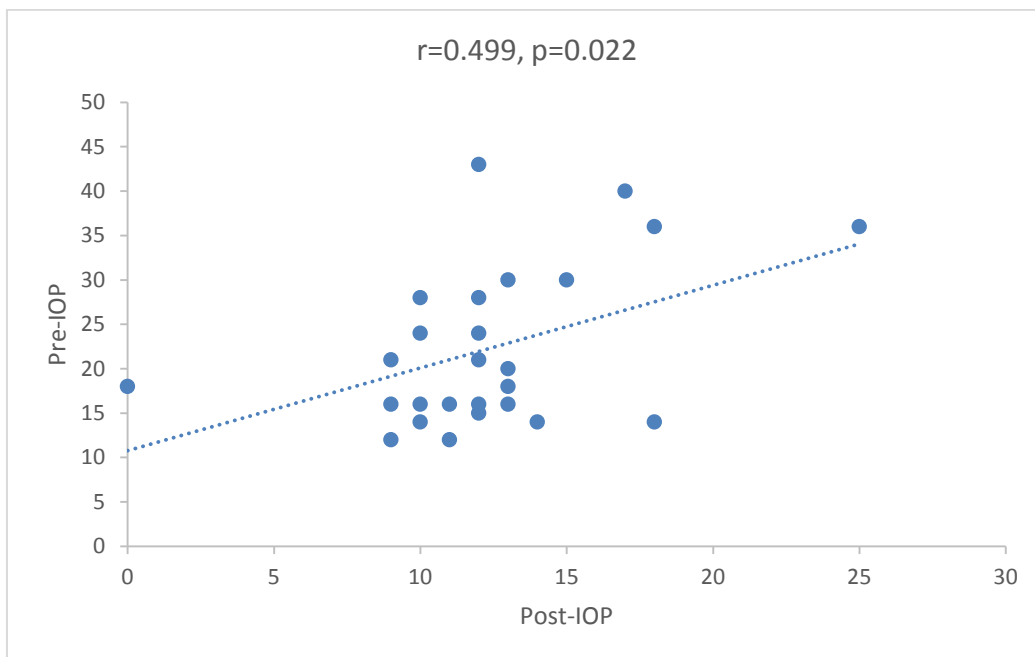
group, one eye had Ahmed valve implant and another eye had G-probe cyclophotocoagulation.

### 3.2 Complications

Three eyes in the Trabeculectomy group developed cataract, while one eye in the phacotrabeculectomy group had persistent hypotony.



**Fig. 1. Scatter Plot for the Pre-and postoperative IOP for Trabeculectomy**



**Fig. 2. Scatter Plot for the Pre-and postoperative IOP for Phaco-Trab**

#### 4. DISCUSSION

The intraocular pressure reduction effect of phacoemulsification combined with trabeculectomy has been noted to have comparable outcome with trabeculectomy alone [10,11]. However, in specific terms, the reduction has been reported to be higher in trab than in the phaco-trab group [10-13]. It has been postulated that phacoemulsification leads to the breach in the blood-aqueous barrier with attendant release of inflammatory mediators resulting in diminished bleb function [2,14]. Nevertheless, combining phacoemulsification or indeed other forms of cataract surgery with trabeculectomy may be inevitable especially in elderly patients with visually significant cataract and medically uncontrolled glaucoma.

Most trabeculectomies are augmented with Mitomycin C (MMC) antimetabolite compared with 5-Fluorouracil (5FU) [15]. Many studies have shown that trabeculectomies augmented with MMC have better IOP reduction compared with those with 5FU [16-17].

In our series where the trabeculectomy was augmented with 5FU, we noted that the intraocular pressure reduction in the eyes that had combined trabeculectomy with phacoemulsification (9.92mmHg; 44.62%) was higher than in those who had trabeculectomy alone (8.31mmHg; 41.84%), though the mean postoperative IOP is lower in the later than the former. This finding contrasts the findings in similar retrospective studies by Singh et al. [12] and Chang et al. [13] in which 5-FU was used for augmentation. Singh et al reported IOP reduction of 12mmHg (52.4%) in the Trabeculectomy group with intraoperative 5-FU use and 7.8mmHg (32.8%) reduction in IOP for Phaco-Trab group [12]. The result by Singh et al. [12] mirrors that of Chang et al. [13] in which they reported IOP reduction of 11.2mmHg (44.6%) in the trabeculectomy group and 7.3mmHg (31.2%) in the Phaco-trab group. In our study, the patients in the trabeculectomy group were much younger than those in the phaco-trab group. In addition, we used a 2-site approach in the phacotrabeulectomy unlike the single-site approach used in both Singh et al and Chang et al studies. A single-site approach in combined trabeculectomy and phacoemulsification has been observed to give a lower IOP control than a 2-site approach [18]. Perhaps these two factors might be responsible for the pattern of finding in our study. Both groups in this study witnessed

significant ( $p>0.001$ ) and comparable reduction in the use of topical antiglaucoma medication.

In term of success using the benchmark of  $\leq 15$ mmHg, the trab group had better Qualified and Complete success than the phaco-trab group as reported by Singh *et al* and Chang et al. [12,13] We reported Qualified Success of 86.20% for the trab group while the phaco-trab group had Qualified success of 80.76%. On the other hand, the Complete success for the trabeculectomy group was 27.58% and 19.23% for the phacotrabeulectomy group. Chang et al. [13] reported Complete Success of 63.8% in the trabeculectomy group and 62.2% in the phacotrabeulectomy group after at least 3 years of follow-up. The Chang and Associates' study also used  $\leq 16$ mmHg cut-off point [13]. In the study by Singh *et al* using  $\leq 16$ mmHg cut-off mark, they reported complete success of 71% in the trabeculectomy group and 55% in the phacotrabeulectomy group after 2 years of follow-up [12]. The complete success reported in our study is very low compared with the result reported by these studies. The difference in the cut-off IOP benchmark between our study and these 2 studies obviously may be a contributory factor.

The significant complications reported in our study included cataract in 3 eyes (10.3%) in the trabeculectomy group and persistent hypotony in the phaco-trab group. Trabeculectomy is known to accelerate the formation of cataract [2]. The percentage of cataract reported in our study is lower than that reported by Singh et al (21%) and Chang et al (34%). Both studies had longer follow-up period than our study. The final best corrected visual acuity in decimal was similar in both groups. As expected, there was significant improvement in BCVA in the phaco-trab but in this study, there was no change in preoperative and postoperative BCVA in the trabeculectomy group.

#### 5. CONCLUSION

In our series, phacotrabeulectomy augmented with 5-Fluorouracil gave higher intraocular pressure reduction than 5-Fluorouracil augmented trabeculectomy alone in contrast with other reports in the literature but both proved the Qualified and Complete success mirrored previously reported pattern. Minimal complications were reported in our study. We can assume that either of the two surgical methods may be effective in the management of

Primary Open Angle Glaucoma when properly chosen.

## DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

## CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Matlach J, Hoffmann N, Freiberg FJ, Grehn F, Klink T. Comparative study of Trabeculectomy using simple sutures versus reliable sutures. *Clin Ophthalmol* 2012;6:10019-1027.
2. Augustinus CJ, Zeyen T. The effect of phacoemulsification and combined phaco/glaucoma procedures on the intraocular pressure in open-angle glaucoma. A review of the literature. *Bull Soc Belge Ophthalmol*. 2012;320:51-66.
3. Bonnie NKC. Comparison of surgical outcome of trabeculectomy and phacotrabeculectomy in Chinese glaucoma patients. 2017;10(12):1928–1930.
4. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol*. 2006; 90:262-7.
5. Ogata-Iwao M, Inatani M, Takihara Y, Inoue T, Iwao K, Tanihara H. A prospective comparison between trabeculectomy with mitomycin C and phacotrabeculectomy with mitomycin C. *Acta Ophthalmol*. 2013;91(6):e500–e501.
6. Shingleton BJ, Gamell LS, O'Donoghue MW, et al. Long-term changes in intraocular pressure after clear corneal phacoemulsification: Normal patients versus glaucoma suspect and glaucoma patients. *J Cataract Refract Surg*. 1999; 25:885-890.
7. Anderson DR, Normal Tension Glaucoma Study. Collaborative normal tension glaucoma study. *Current Opinion in Ophthalmology*. 2003;14(2):86-90.
8. Leske MC, Heijl A, Hussein M, Bengtsson B, Hyman L, Komaroff E, Early manifest glaucoma trial group. Factors for glaucoma progression and the effect of treatment: the early manifest glaucoma trial. *Arch Ophthalmol*. 2003;121:48-56.
9. Vass C, Hirn C, Sycha T, Findl O, Bauer P, Schmetterer L. Medical interventions for Primary open angle glaucoma and ocular hypertension. *Cochrane Database Syst Rev*. 2007;17:CD003167.
10. Gimbel HV, Meyer D, DeBroff BM et al. Intraocular pressure response to combined phacoemulsification and trabeculectomy ab externo versus phacoemulsification alone in primary open-angle glaucoma. *J Cataract Refract Surg*. 1995;21:635-660.
11. Kleinmann G, Katz H, Pollack A, Schechtman E, Rachmiel R, Zalish M. Comparison of trabeculectomy with mitomycin C with or without phacoemulsification and lens implantation. *Ophthalmic Surg Lasers*. 2002;33:102–108.
12. Singh RP, Goldberg I, Mohsin M. The efficacy and safety of intraoperative and/or postoperative 5-Fluorouracil in trabeculectomy and phacotrabeculectomy. *Clin Exp Ophthalmol* 2001;29:296-302.
13. Chang L, Thiagarajan M, Mosely M, Woodruff S, Bentley C, Khaw PT, et al. Intraocular pressure outcome in Primary 5FU phacotrabeculectomies compared with 5 FU trabeculectomies. *J Glaucoma*. 2006;15:475-481.
14. Siriwardena D, Kotecha A, Minassian D, et al. Anterior chamber flare after trabeculectomy and after phacoemulsification. *Br J Ophthalmol*. 2000; 84:1056–1057. (inflammatory mediators)
15. Jampel HD, Friedman DS, Lubomski LH, et al. Effect of technique on intraocular

- pressure after combined cataract and glaucoma surgery: an evidence-based review. *Ophthalmology*. 2002;109:2215–2224.
16. Anand N, Dawda VK. A comparative study of Mitomycin C and 5-Fluorouracil Trabeculectomy in West Africa. *Middle East Afri J Ophthalmol*. 2012;19:147-152.
17. De Fend LT, Arruda GV, Scott IU, Paula JS. Mitomycin C versus 5-Fluorouracil as an adjunctive treatment for trabeculectomy: a meta-analysis of randomized clinical trials. *Clin Exp Ophthalmol* 2013;41:798-806.
18. Wyse T, Meyer M, Ruderman JM, Krupin T, Talluto D, Hernandez R et al. Combined trabeculectomy and phacoemulsification: a one-site vs a two-site approach. *Am J Ophthalmol*. 1998; 125:334-339.

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